Savannah River Site
Solid Waste Management Department
Consolidated Incinerator Facility Project
Operator Training Program

BLENDED WASTE SYSTEM (U)

Study Guide

ZIOITX13

Revision 03

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Training Manager / Date

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Engineering / Date

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Facility Manager / Date

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REVISION LOG

REV.	AFFECTED SECTION(S)	SUMMARY OF CHANGE
00	All	New Issue
01	All	Update
02	All	Update
03	All	Format change and update

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REFERENCES

1. SE5-2-2006265, *CIF Tank Farm Logic Diagram Sheet 19 Instruments,* Rev. 1

2. SE5-2-2006267, *CIF Tank Farm Logic Diagram Sheet 21 Instruments,* Rev. 1

3. SE5-2-2006178, *CIF Tank Farm Logic Diagram Sheet 4 Instruments,* Rev. 1

4. SE5-2-2006180, *CIF Tank Farm Logic Diagram Sheet 6 Instruments* Rev. 1

5. WSRC-SA-17, *Consolidated Incineration Facility Safety Analysis Report* (DOE Approval Copy 12/95)

6. W830307, Savannah River Site Building 262-H Area 200-H *Blend Tank No. 1 Process Serv PPG & Inst Diag Process and Instruments (U),* Rev. 48

7. W830308, Savannah River Site Building 262-H Area 200-*H Blend Tank No. 2 Process Serv PPG & Inst Diag Process and Instruments (U),* Rev. 50

8. W830313, *RK Waste Liquid Burner Sh 1 Pwr, Serv. PPG & Inst Diag-Process and Instrumentation,* Rev. 16

9. W830314, *RK Waste Liquid Burner Sh 2 Pwr, Serv. PPG & Inst Diag-Process and Instrumentation,* Rev. 14

10. ZIOISX13, *Blended Rad Waste System Design Description,* Rev. 0

LEARNING OBJECTIVES

TERMINAL OBJECTIVE

1.00 Without references, **EXPLAIN** the significance of the Blended Waste System to Consolidated Incinerator Facility operations, including its importance to safety, methodology of operations, and the impact on operations of a failure of the system.

ENABLING LEARNING OBJECTIVES

1.01 **STATE t**he purpose of the Blended Waste System.

1.02 Briefly **DESCRIBE** how the Blended Waste System accomplishes its intended purpose.

1.03 **EXPLAIN** the consequences of a failure of the Blended Waste System to fulfill its intended purpose, including the effects on other systems or components, overall plant operation, and safety.

TERMINAL OBJECTIVE

2.00 Using system diagrams, **EVALUATE** potential problems which could interfere with normal Blended Waste System flowpaths to determine their significance on overall system operation and the corrective actions needed to return the system to normal.

ENABLING LEARNING OBJECTIVES

2.01 **SKETCH** a simplified diagram of the Blended Waste System arrangement, showing the following system components and interfaces with other systems:

a. Blend Tanks
b. Blend Tank Transfer Pumps
c. Blended Waste Feed Pump
d. RK Skids
e. RK Waste Liquid Burner
f. Automatic Sampling System

2.02 **DESCRIBE** the physical layout of the Blended Waste System components including, the general location, system interfaces, and the functional relationship for each of the following major components:

a. Blend Tanks
b. Agitators
c. Immersion Heaters
d. Blend Tank Transfer Pumps
e. Blended Waste Feed Pump
f. RK Skids
g. RK Waste Liquid Burner

2.03 Given a description of the Blended Waste System equipment status, **IDENTIFY** conditions which interfere with normal system flowpaths.

2.04 Given a description of abnormal equipment status for the Blended Waste System, **EXPLAIN** the significance of the condition on system operation.

2.05 Given a description of the Blended Waste System equipment status, **STATE** any corrective actions required to return system operation to a normal condition.

TERMINAL OBJECTIVE

3.00 Given values of Blended Waste System operation parameters, **EVALUATE** potential problems that could effect the normal functioning of the system or its components to determine the significance of the existing condition and the actions required to return the system to normal operation.

ENABLING LEARNING OBJECTIVES

3.01 **DESCRIBE** the following major components of the Blended Waste System including their functions, principles of operation, and basic construction:

a. Blend Tanks
b. Agitators
c. Immersion Heaters
d. Blend Tank Transfer Pumps
e. Blended Waste Feed Pump
f. RK Skids
g. RK Waste Liquid Burner

3.02 **STATE** the operational limitations for the following Blended Waste System major components:

a. Blend Tanks
b. Agitators
c. Immersion Heaters
d. Blend Tank Transfer Pumps
e. Blended Waste Feed Pump
f. RK Skids
g. RK Waste Liquid Burner

3.03 Given values for key performance indicators, **DETERMINE** if Blended Waste System components are functioning as expected.

3.04 **DESCRIBE** the following Blended Waste System instrumentation including indicator location (local or Control Room), sensing points, and associated instrument controls:

a. Blend Tank level
b. Blend Tank temperature
c. Blend Tank nitrogen pressure
d. Corrosion transmitter
e. RK Blended Waste pressure
f. RK Blended Waste steam flow
g. RK Blended Waste steam pressure
h. Blended Waste feed flow
i. Blended Waste feed temperature

3.05 **INTERPRET** the following Blended Waste System alarms, including the conditions causing alarm actuation and the basis for the alarms:

a. Blend Tank level
b. Blend Tank temperature
c. Blend Tank nitrogen pressure
d. Blend Tank corrosion
e. RK Blended Waste pressure
f. RK Blended Waste steam flow
g. RK Blended Waste steam pressure
h. Blended Waste feed flow
i. Blended Waste feed temperature

3.06 **EXPLAIN** how the following Blended Waste System equipment is controlled in all operating modes or conditions to include: control locations (local or Control Room), basic operating principles of control devices, and the effects of each control on the component operation:

a. Blended Waste Transfer Pumps
b. Blend Tank Agitators
c. Tank Temperature Control
d. Blended Waste Feed Pump

3.07 **DESCRIBE** the interlocks associated with the following Blended Waste System equipment to include the interlock actuating conditions, effects of interlock actuation, and the reason the interlock is necessary:

a. Blend Tank Immersion Heaters
b. Blend Tank Agitators
c. Blend Tank Transfer Pumps
d. Blend Tank Transfer Pumps Discharge Valves
e. Blend Tank Valve to Spare Tank

TERMINAL OBJECTIVE

4.00 Given necessary procedures or other technical documents and system conditions, **DETERMINE** the operator actions required for normal and off normal operation of the Blended Waste System including problem recognition and resolution.

ENABLING LEARNING OBJECTIVES

4.01 Given applicable procedures and plant conditions, **DETERMINE** the actions necessary to perform the following Blended Waste System operations:

a. Startup
b. Normal Operation of Equipment
c. Shutdown

4.02 **DETERMINE** the effects on the Blended Waste System and the integrated plant response when given any of the following:

a. Indications/alarms
b. Malfunctions/failure of components
c. Operator Actions

SYSTEM OVERVIEW

Safety

All personnel should be aware of the importance of safety. To prevent any mishaps from occurring, personnel should follow the guidelines set forth in WSRC 4Q, *Industrial Hygiene Manual* and WSRC 8Q, *Employee Safety Manual*.
Introduction

The Blended Waste System consists of two blend tanks, associated valves, pumps, and piping. The Blend Tanks provide the ability to mix Radioactive (Rad) Oils/Solvents with organic, non-radioactive hazardous wastes and No. 2 fuel oil. This is done to ensure that the mixture has the desired properties of viscosity, heating value, ash, and chlorine content. Controlling these properties will ensure stable incineration in the Rotary Kiln (RK).

Rad Oils/Solvents is a term used for materials that include tritiated lubricating oils, organic waste from Naval Fuels, and purex solvents. Organic, Non-Radioactive Hazardous Wastes (Organic NRHW) consist of paint solids, process oils, and high Btu organic solvents. Aqueous waste, with a heat value over 5000 Btu/lb, can be added to the mix.

Hazards Associated with Blended Waste

Inhalation of fumes and the flammability of Blended Waste are safety concerns for CIF operators. There is also a possibility of radiation exposure from the tritiated oils being handled. Many organic compounds have been linked to cancer (carcinogens). Purex solvents will contain plutonium, which is a toxic metal, even in small quantities and other radioactive contaminants. It is essential to follow all safety precautions and operating procedures when dealing with the Blended Waste System.

SYSTEM PURPOSE

ELO 1.01 STATE the purpose of the Blended Waste System.

The purpose of the Blended Waste System is to:

- receive liquid waste from the Rad Oils/Solvents Unloading System, Spare Tank System, and Aqueous Waste System.
- allow for the addition of fuel oil from the Fuel Oil Storage Tank.
- support sampling of Blended Waste to ensure BTU content is a minimum of 7500 BTU/pound prior to sending it to the RK Waste Liquid Burner for incineration.

The Blended Waste System is shown in Figure 1 *Blended Waste System* Diagram.

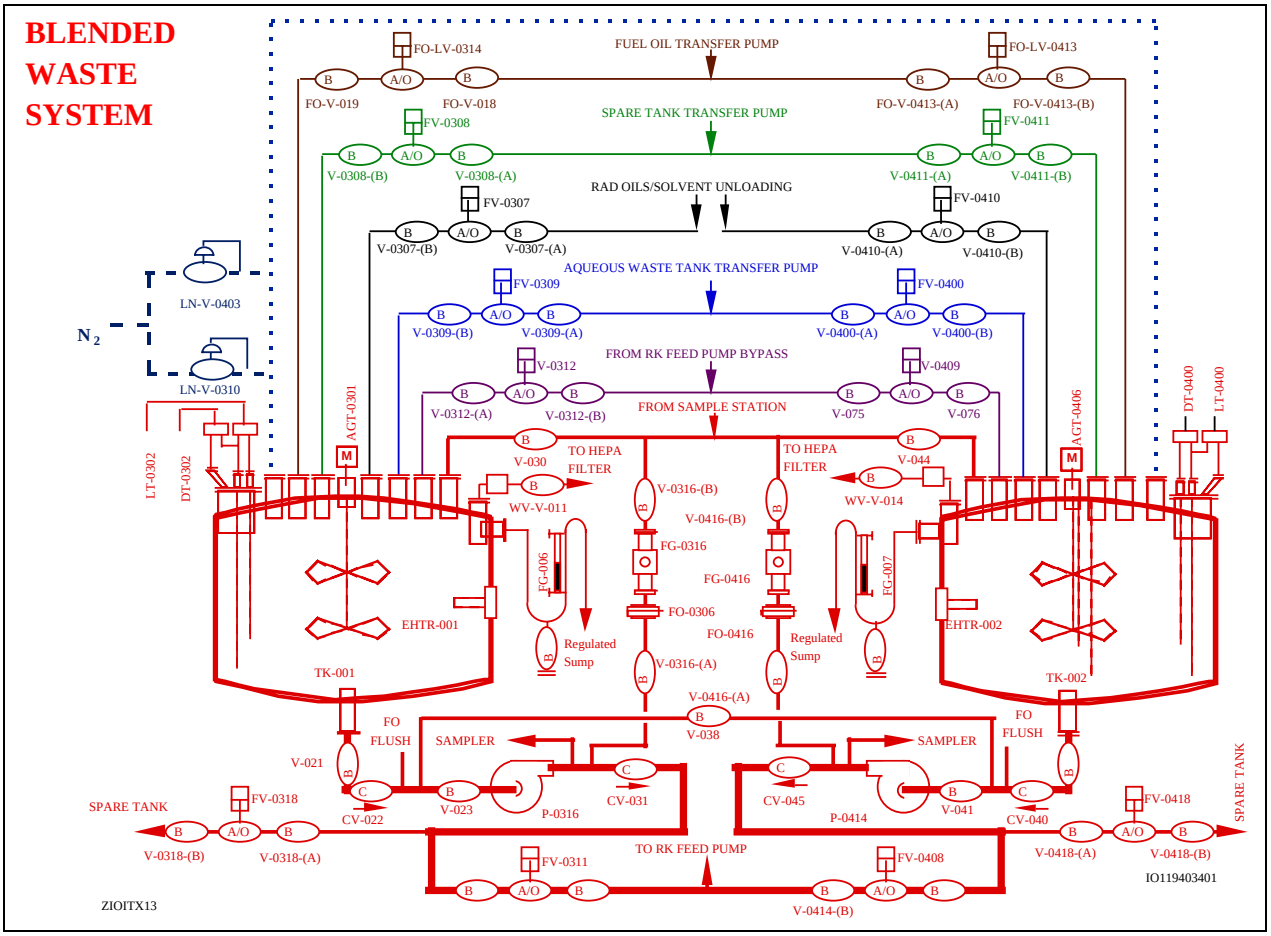


Figure 1 Blended Waste System Diagram

The Blend Tanks can be supplied with liquid wastes from three sources; Rad Oils/Solvents Unloading System, Spare Tank System, and Aqueous Waste System. In addition to the three

waste sources, No. 2 Fuel Oil can be supplied to the Blend Tanks from the Fuel Oil System. Fuel Oil would be mixed with the waste prior to metering to the Rotary Kiln (RK) to increase the heat value (Btu) of the Blended Waste as necessary.

Figure 2, *Tank Farm Layout*, shows the general arrangement of the waste tanks and associated equipment in the CIF Tank Farm.

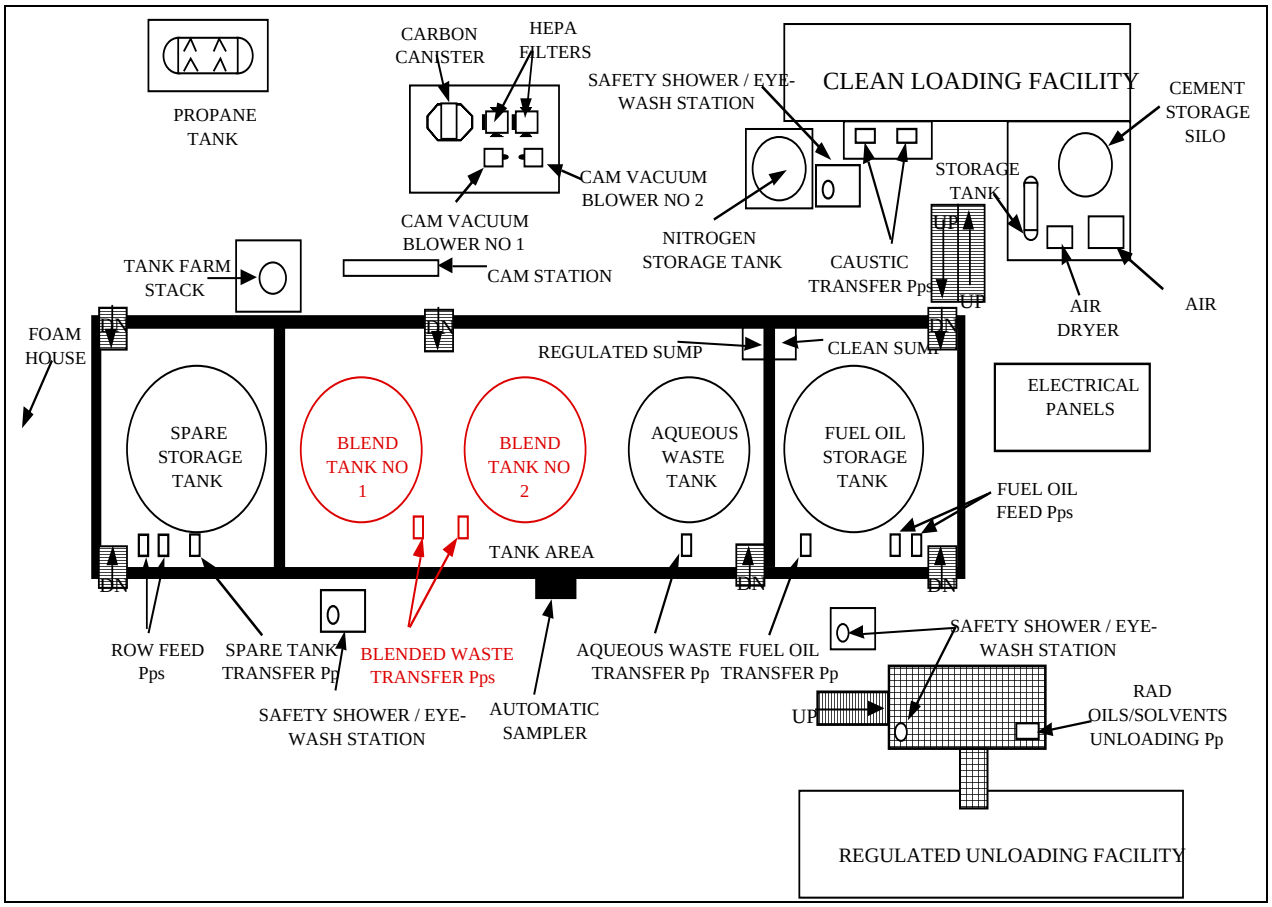


Figure 2 Tank Farm Layout

DESCRIPTION & FLOWPATH

ELO 1.02	**Briefly DESCRIBE how the Blended Waste System accomplishes its intended purpose.**

The purpose of the Blend Tanks is to mix Rad Oils/Solvents with Organic, Non-radioactive Hazardous Wastes and No. 2 Fuel Oil in order to attain a combustible blend to be burned in the Rotary Kiln (RK). Rad Oils/Solvents is a term used collectively to include tritiated lubricating oils, naval fuel organic waste, and purex solvents. Organic, non-radioactive hazardous wastes (Organic NRHW) consist of paint solids with particulates, process oils, and high Btu organic solvents. Aqueous waste, with a heat value over 5,000 Btu/lb, can be added to the mix.

The blend waste system consists of 2 nominal 4200-gallon tanks, 2 recirculation pumps, a filter, and a singular blend pump which delivers waste to the RK Feed Pump. Liquid wastes are delivered to the tank farm or the blend waste tanks in 1000-gallon portable tanks called carboys or by trucks. Wastes are transferred from the regulated unloading area to the blend waste tanks via a diaphragm (air driven) pump. Upon reaching the high level setpoint in the blend tanks, a switch is activated and closes the fill valve in the tank inlet line.

The purpose of the blend waste tanks is to provide a holding and mixing volume for the waste. An agitator is provided to keep waste solids in suspension. Once adequate suspension is achieved, the waste is sampled to determine the organic content from which the heating value can be calculated. At this time, No. 2 Fuel Oil will be added to blended waste, then pumped to the incinerator for combustion via the respective recirculation pump, metering pump and RK Waste Liquid Burner. The blend tanks serve as part of the spill containment and collection system. The clean and regulated sump pumps will direct contaminated spilled liquids to the aqueous waste tank through a duplex strainer, which then can be transferred to the blend tank after a caloric analysis is completed. The blend tanks have overflow capability to the regulated sump.

The Blend Tanks are configured to transfer waste products from either blend tank to the other, the spare tank, or to the aqueous waste tank via either of the blend recirculation pumps. The blending tanks also have the capability of receiving products from either blend tank, spare tank, and aqueous waste tank via the respective transfer pumps.

The planned mode of operation is to batch feed wastes to the RK waste burner while the other blend tank is receiving and/or blending waste liquids and fuel oil or being sampled for the next batch feed. The tanks must be operated in a batch mode due to a regulatory requirement that the amount and composition of wastes to be burned in the RK be known and documented prior to incineration.

A clean sweep filter is located in the common discharge line of the recirculation pumps to remove solids and to prevent plugging of the RK Waste Liquid Burner.

The blend recirculation pumps are centrifugal pumps capable of handling paint solids and sump solids present in the blend tank.

The RK Blend Feed pump is a high performance diaphragm pump capable of handling these solids. The flow of blended waste is measured at the RK remote skid with a mass flowmeter. The flowmeter sends a signal to a controller in the Distributed Control System (DCS). The controller compares this signal to the setpoint, then adjusts the metering pump accordingly.

Atomizing steam is fed to the RK Waste Liquid Burner at a constant pressure of 120 psig. Atomizing steam is used to cool the gun, and provide atomization of the fuel for a more efficient flame pattern.

The RK Waste Liquid Burner has a dedicated fan to supply combustion air. RK waste liquid control is achieved through the operator, who manually sets the base load for the lead-lag control of waste liquid and combustion air flows. Control will provide override for cooling if RK temperature becomes excessive and will reduce waste liquid flow and increase combustion air flow.

ELO 1.03	**EXPLAIN the consequences of a failure of the Blended Waste System to fulfill its intended purpose, including the effects on other systems or components, overall plant operation, and safety.**

A failure of the Blended Waste System would cause the CIF to stop receiving or incinerating liquid waste with a BTU content > 5000 btu/lbm. Leaks anywhere in Blended Waste System would cause the RK Waste Liquid Burner to be secured by a mandatory shutdown. This would also create a safety hazard to personnel due to the flammability of blended waste and potential hazardous material content of blended waste. The CIF could continue to incinerate solid waste and ROW as long as there are no combustible gas detector alarms at the facility.

ELO 2.03 **Given a description of the Blended Waste System equipment status, IDENTIFY conditions which interfere with normal system flowpaths.**

The flow path for Blended Waste originates in one of the Blend Tanks and passes through the associated Blended Waste Transfer Pump (See Figure 1) to the Blend Feed (metering) Pump on the RK Remote Burner Skid (Figure 3, *RK Remote Burner Skid*). From the Blend Feed Pump flow is metered to the RK Local Burner Skid and then to the RK Waste Liquid (WL) Burner (Figure 4, *RK Local Burner Skid*). Normal system flowpath can be interrupted by several different conditions, such as:

- closing any valves in the normal flowpath (manually or pneumatically).
- failure of the transfer or feed pump (mechanically or electrically).
- a leak in the system piping or components.
- loss of normal site electrical power.
- a loss of cooling/atomization steam to the RK Waste Liquid Burner (various causes).
- operator error in performing procedural steps.

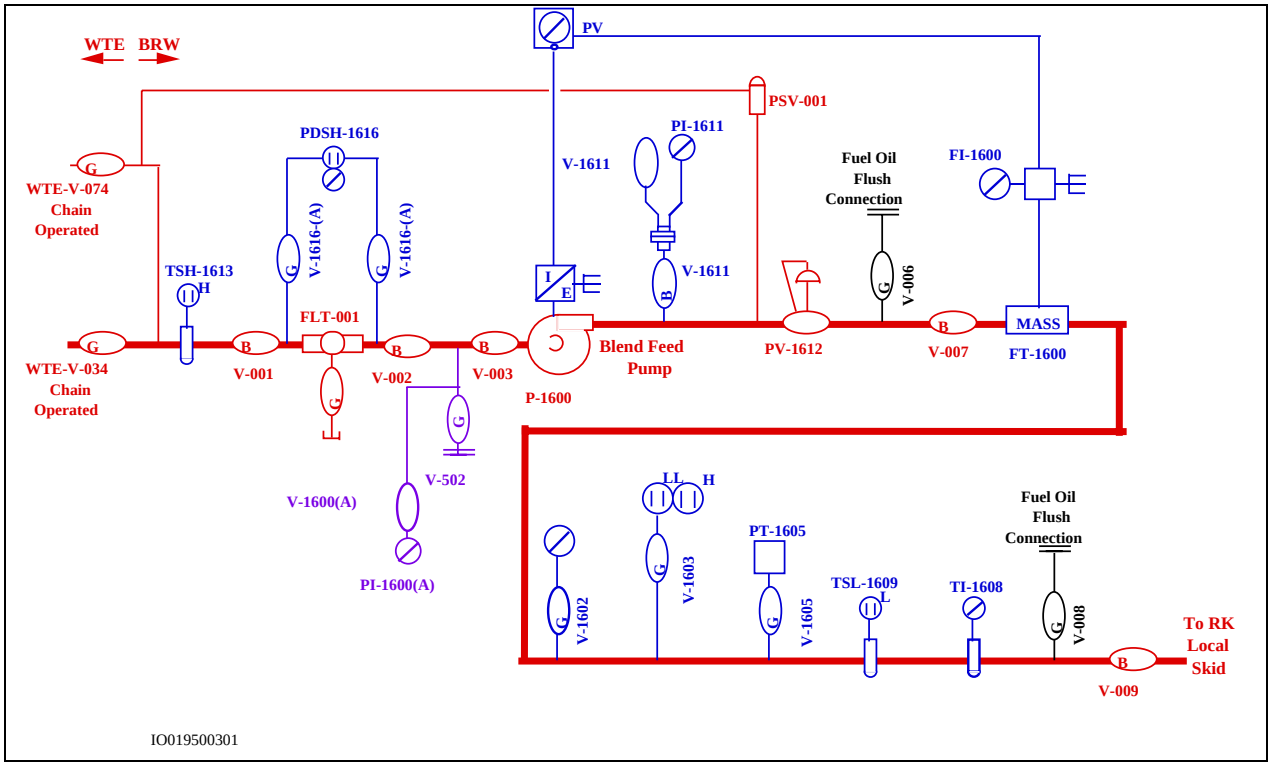


Figure 3 RK Remote Burner Skid

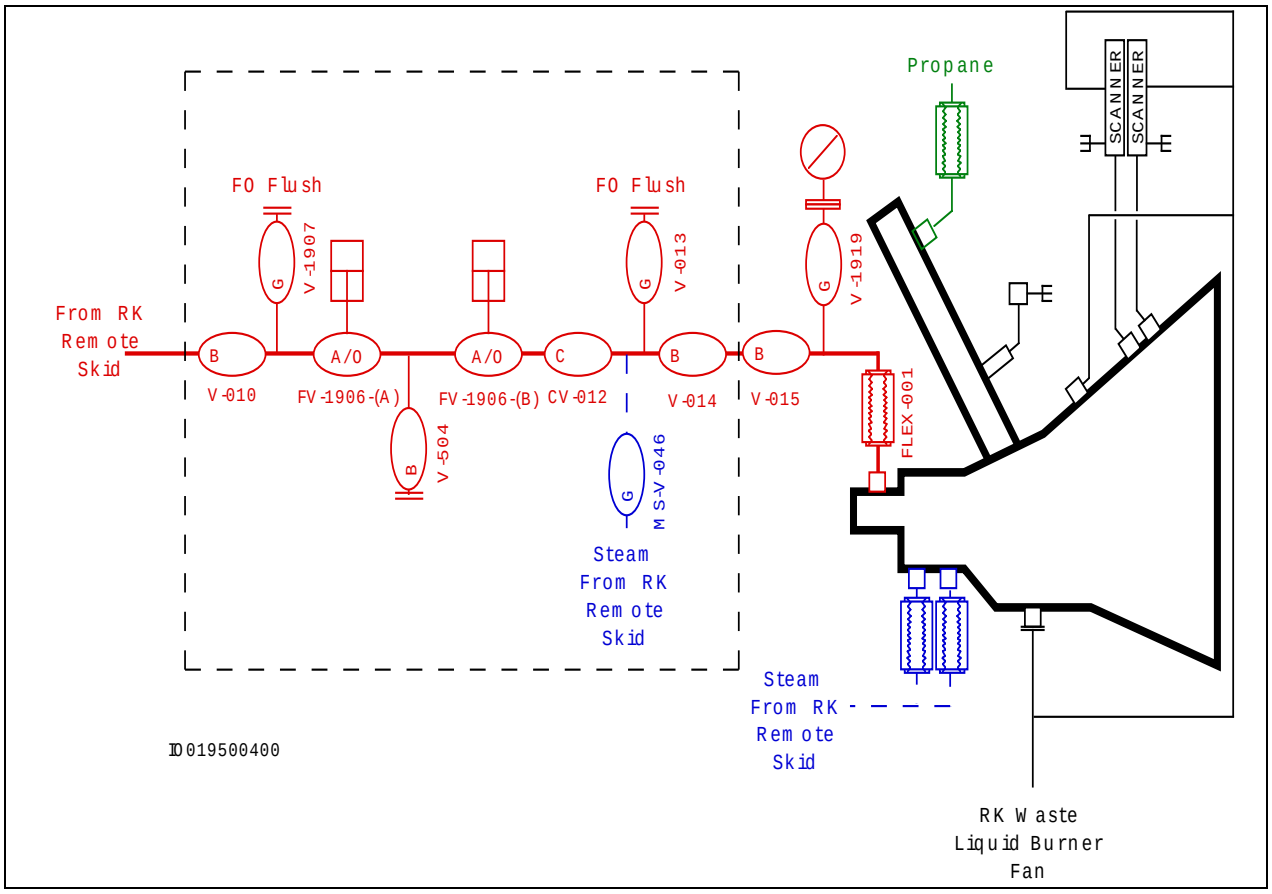


Figure 4 RK Local Burner Skid

While there are four sources (three waste sources and fuel oil) that can pump to the Blend Tanks, only one source at a time may charge to either of the tanks.

There are two Blend Tank Transfer Pumps. Normally Blend Tank No. 1 is served by Pump No. 1 and Blend Tank No. 2 is served by Pump No. 2. Although piping is installed that allows either pump to serve either tank, this should not normally be utilized (only use on pump failure) since it eliminates all tank level/pump interlocks. The pumps are designed to circulate Blended Waste from the Blend Tanks to the suction of the Blend Feed Pump and back to the tank from where it came. The Blend Tank Transfer Pumps also supply the motive force to circulate Blended Waste through a one-inch line to the Tank Farm Automatic Sampler (See Figure 5 *Tank Farm Automatic Sampler*) for sampling purposes. Each of the pumps is provided with a one-inch branch line with an orifice that returns 10 gpm to the tank. These lines prevent a dead head condition by providing a minimum recirculation flow for the pumps. Piping is installed for both the sample lines and the recirculation lines to direct return flow back to the tank from which the fluid originates (when using the associated transfer pump). In the rare event that the Shift Supervisor (SS) determines that it is necessary, the contents of one Blend Tank can be transferred to the other Blend Tank via the recirculating loop. Also, if directed by the SS, in an emergency or as required to support process operations, Blend Tank contents can be pumped to the Spare Tank.

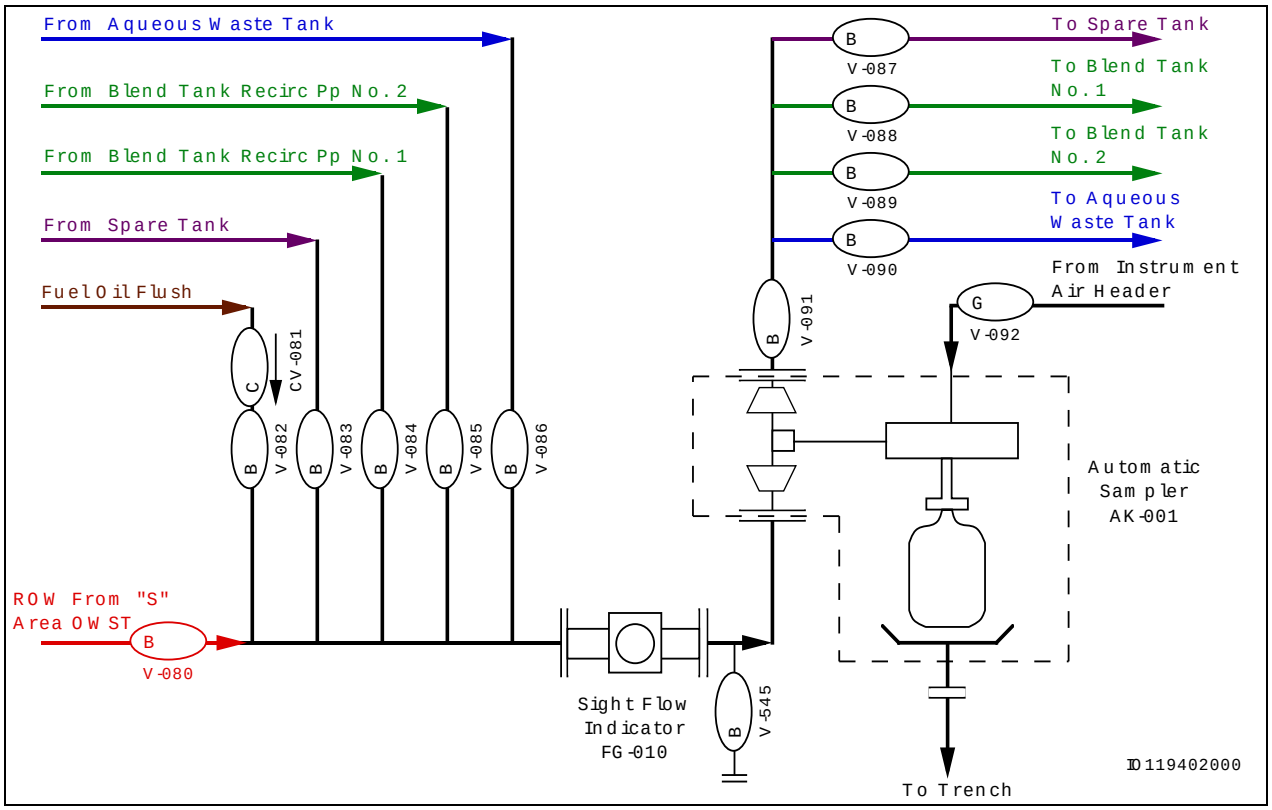


Figure 5 Tank Farm Automatic Sampler

ELO 2.01	**SKETCH a simplified diagram of the Blended Waste System arrangement, showing the following system components and interfaces with other systems:** **a. Blend Tanks** **b. Blend Tank Transfer Pumps** **c. Blended Waste Feed Pump** **d. RK Skids** **e. RK Waste Liquid Burner** **f. Automatic Sampling System**

A simplified drawing of the Blended Waste System is provided to aid in understanding the basic flowpath from the tanks, through the transfer pump, auto sampler tap-off, feed pump/remote skid, local skid, and RK Burner. See Figure 6, *Blended Waste Simplified Drawing*.

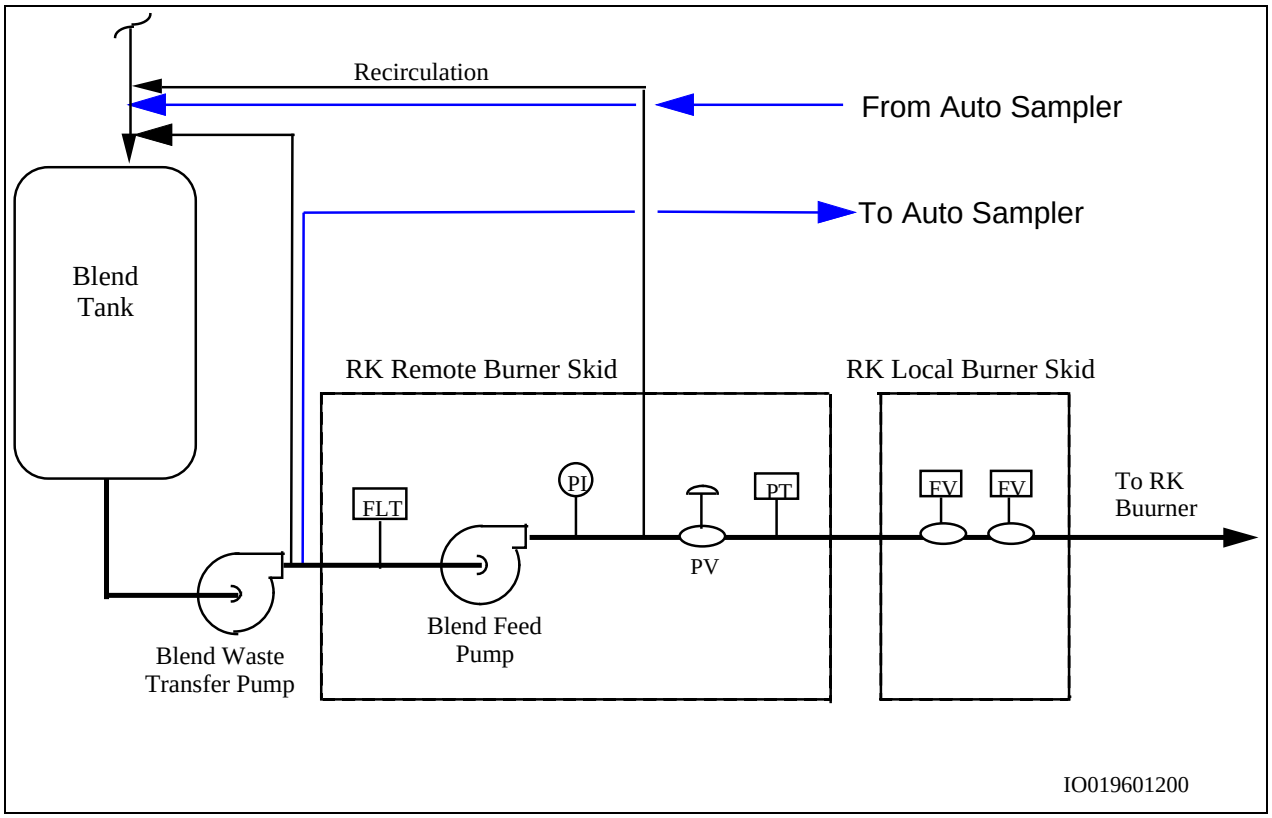


Figure 6, Blended Waste Simplified Drawing.

Summary

- The Blend Tanks can be supplied with liquid wastes from three sources; Rad Oils/Solvents Unloading System, Spare Tank System, and Aqueous Waste System.
- Fuel Oil is mixed with the waste prior to metering to the Rotary Kiln (RK) to increase the heat value (Btu) of the Blended Waste as necessary.
- The flow path for Blended Waste originates in one of the Blend Tanks and passes through the associated Blended Waste Transfer Pump to the Blend Feed (metering) Pump on the RK Remote Burner Skid (Figure 3). From the Blend Feed Pump, flow is metered to the RK Local Burner Skid and then to the RK Waste Liquid (WL) Burner.
- While there are four sources that can pump to the Blend Tanks (3 waste sources and 1 fuel oil source), only one source at a time may charge to either of the tanks.

MAJOR COMPONENTS

ELO 2.02	**DESCRIBE the physical layout of the Blended Waste System components including, the general location, and functional relationship for each of the following major components:** **a. Blend Tanks** **b. Agitators** **c. Immersion Heaters** **d. Blend Tank Transfer Pumps** **e. Blended Waste Feed Pump** **f. RK Skids** **g. RK Waste Liquid Burner**
ELO 3.01	**DESCRIBE the following major components of the Blended Waste System including their functions, principles of operation, and basic construction:** **a. Blend Tanks** **b. Agitators** **c. Immersion Heaters** **d. Blend Tank Transfer Pumps** **e. Blended Waste Feed Pump** **f. RK Skids** **g. RK Waste Liquid Burner**
ELO 3.02	**STATE the operational limitations for the following Blended Waste System major components:** **a. Blend Tanks** **b. Agitators** **c. Immersion Heaters** **d. Blend Tank Transfer Pumps** **e. Blended Waste Feed Pump** **f. RK Skids** **g. RK Waste Liquid Burner**

Blend Tanks

Blend Tank No. 1 and No. 2 are each 4,200 gallon carbon steel vessels located in the middle compartment of the diked area of the Tank Farm (see Figure 7, *Blend Tank Capacities & Levels*). They are designed to withstand up to 10 psig positive pressure plus static head or 2.5 psig negative pressure at 200 °F. Each tank is 14 feet 6 inches in height and 8 feet in diameter. Four baffles, each 10 feet 4 5/8-inches high by 8 inches wide by 3/8 inch thick, are mounted inside each tank 90° apart. The tank is insulated with 2 inches of polyisocyanurate insulation. Tank legs are protected with 3 hour NFPA fireproofing. The operational volume for the Blend Tanks is approximately 3900 gallons.

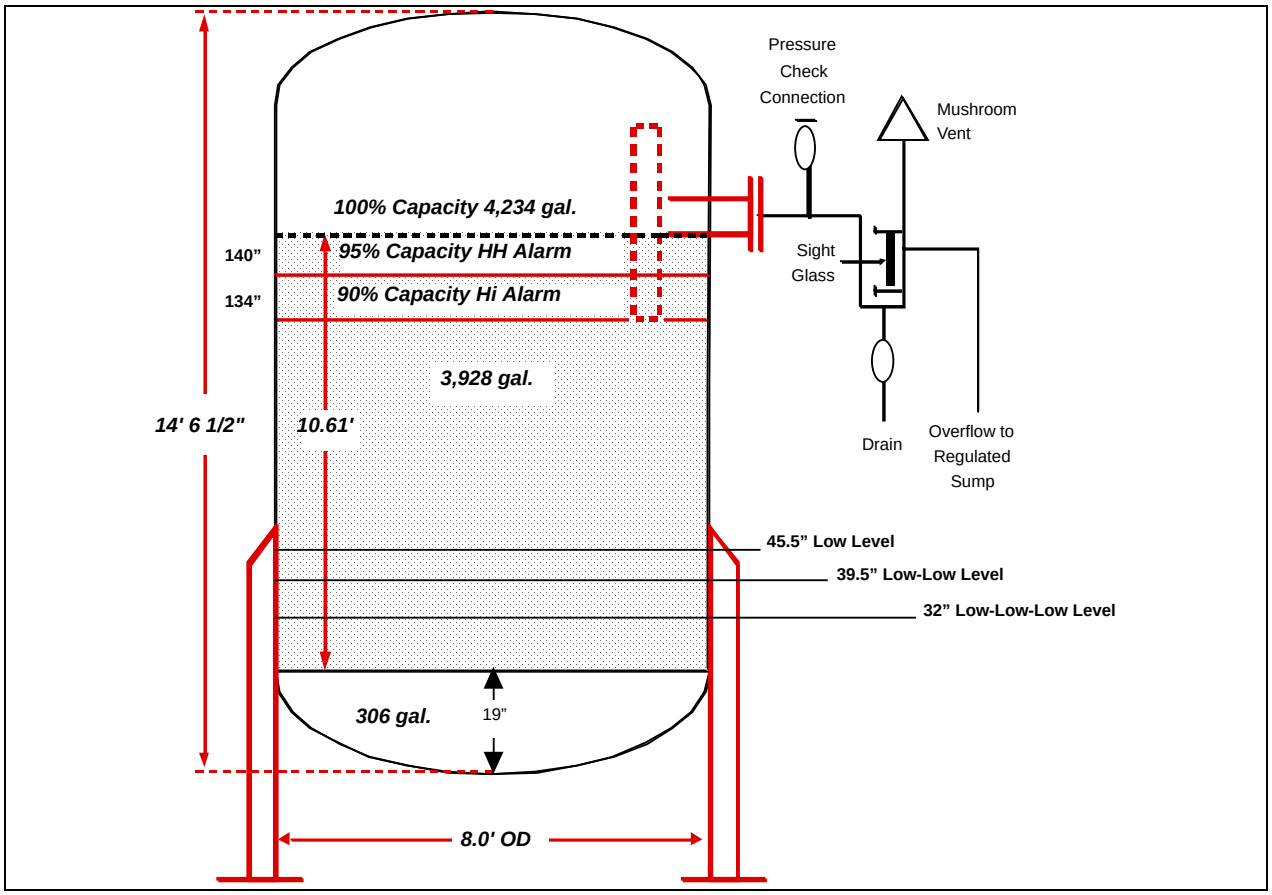


Figure 7 Blend Tank Capacities & Levels

Blend Tank Loop Seal System

Each of the waste tanks, including the Blend Tanks, are equipped with a conservation vent, flame arrester, and a rupture disc and a loop seal. See Figure 8, Loop Seal System.

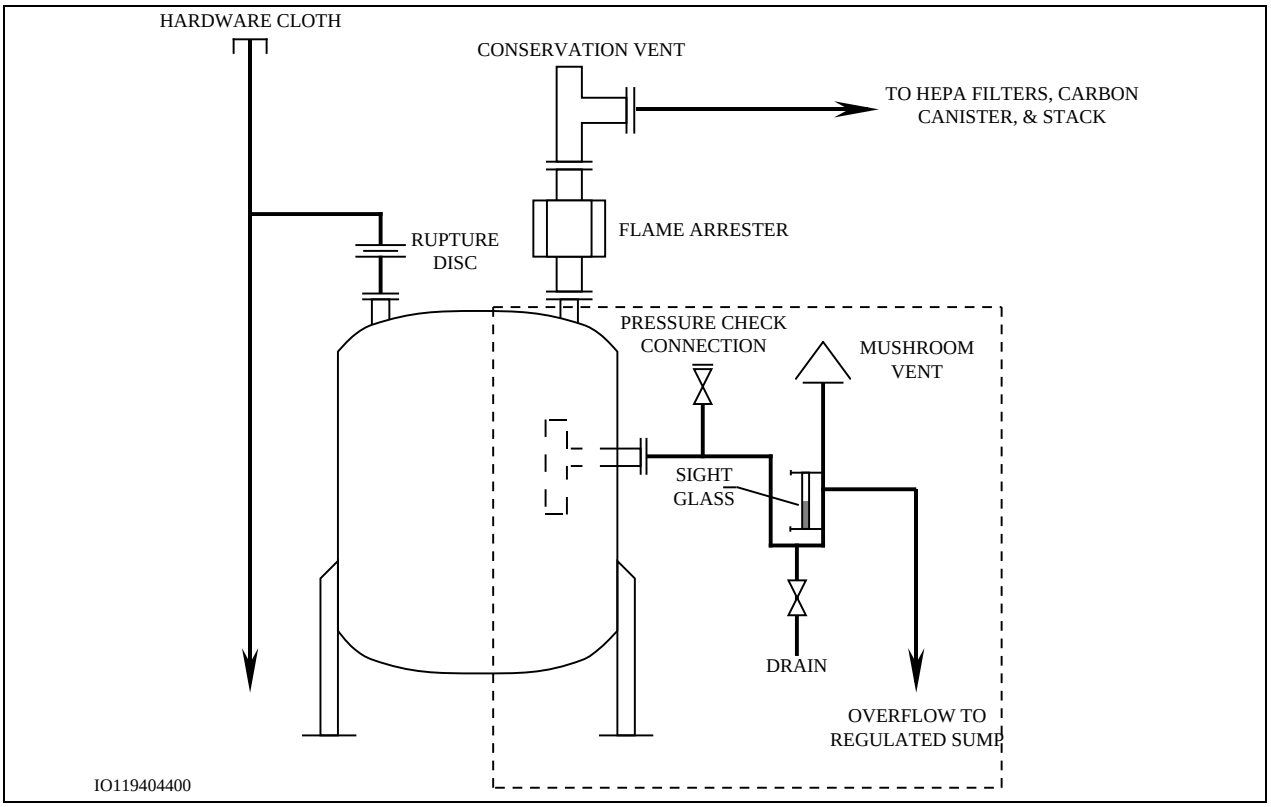


Figure 8 Loop Seal System

The Waste Vent System is equipped with a flame arrester and conservation vent. Nitrogen is supplied to all Tank Farm Waste Tanks to act as a inert blanket on top of the tanks. This nitrogen blanketing is maintained between 2-8 inwc. These components are provided for the normal expulsion of nitrogen and hydrocarbon vapors during a tank filling mode and/or outbreathing due to an increase in temperature inside the tank. The conservation vents (PSV-001/PSV-002) will not open until the gas pressure in the tank is 8 inwc. The flame arresters (FAR-001/FAR-002) prevents the propagation of a flame from outside the stack back into the vent system.

The Loop Seal System works in conjunction with the rupture disc to provide over-pressure protection and vacuum protection for the waste tanks in the Tank Farm. The loop seal is designed to cause the rupture disk to break on positive pressure before it overflows and to collapse (purge seal fluid to tank) on partial vacuum before the rupture disk breaks. The loop seal will withstand 2.38 psig positive pressure before it overflows and will collapse at 2.38 psig negative pressure. The rupture disc is designed to break at 1.5 psig positive pressure and to

withstand a minimum pressure of 2.50 psig negative pressure. See Figure 9, *Blend Tank Pressures*.

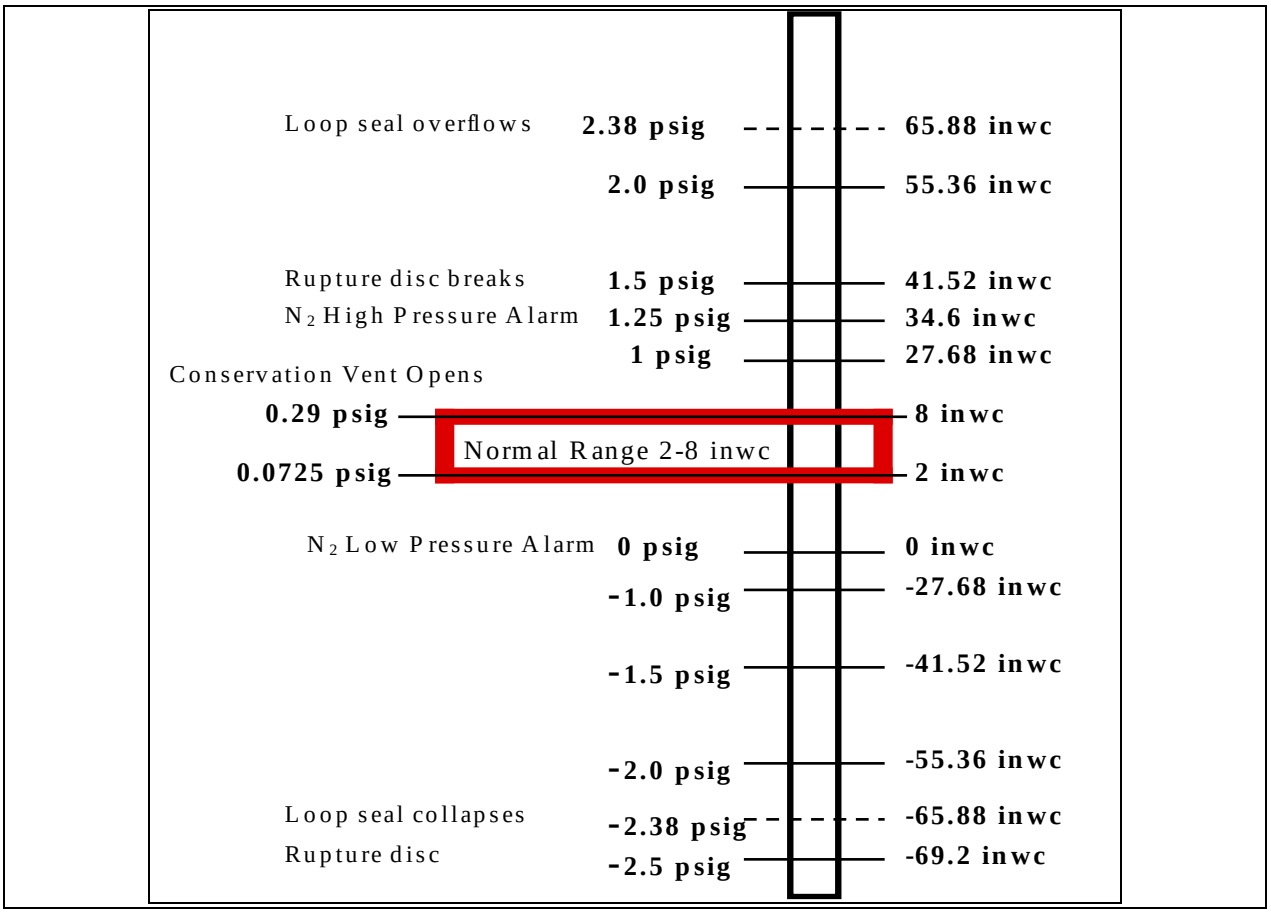


Figure 9 Blend Tank Pressures

The overflow loop seal is equipped with a sight glass on the outside leg of the seal. Before a tank is purged with nitrogen, and with the inside of the tank at atmospheric pressure, the loop seal should be charged with a thoroughly mixed 50% - 50% solution of water and ethylene glycol (To prevent freezing of the liquid in the loopseal). The overflow loop seal is equipped with a mushroom vent on the outside leg. This vent is to assure atmospheric pressure on the outside leg even if the end of the overflow to the sump is under water or liquid waste.

Immersion Heaters

Each tank is equipped with one 9-kw electric heater constructed of Incolloy™ which is installed inside 6-inch schedule 40 pipe. The immersion heaters are utilized to control the temperature of the Blended Waste which in turn helps control the viscosity. The heater installation (in a sheath) allows removal without draining the tank. The heaters operate on 480-volt, three phase power and are suitable for National Electric Code (NEC) Hazardous Class I, Division 2 Service. The heaters are powered from MCC 3 Cubicles 1A/1C. The tanks are insulated with 2 inch polyisocyanurate insulation. and the legs of the tanks are protected with 3 hour. NFPA fireproofing. The immersion heaters will maintain the contents of the Blend Tanks between 47˚F

and 57˚F. See Figure 10, Blend Tank Immersion Heater.

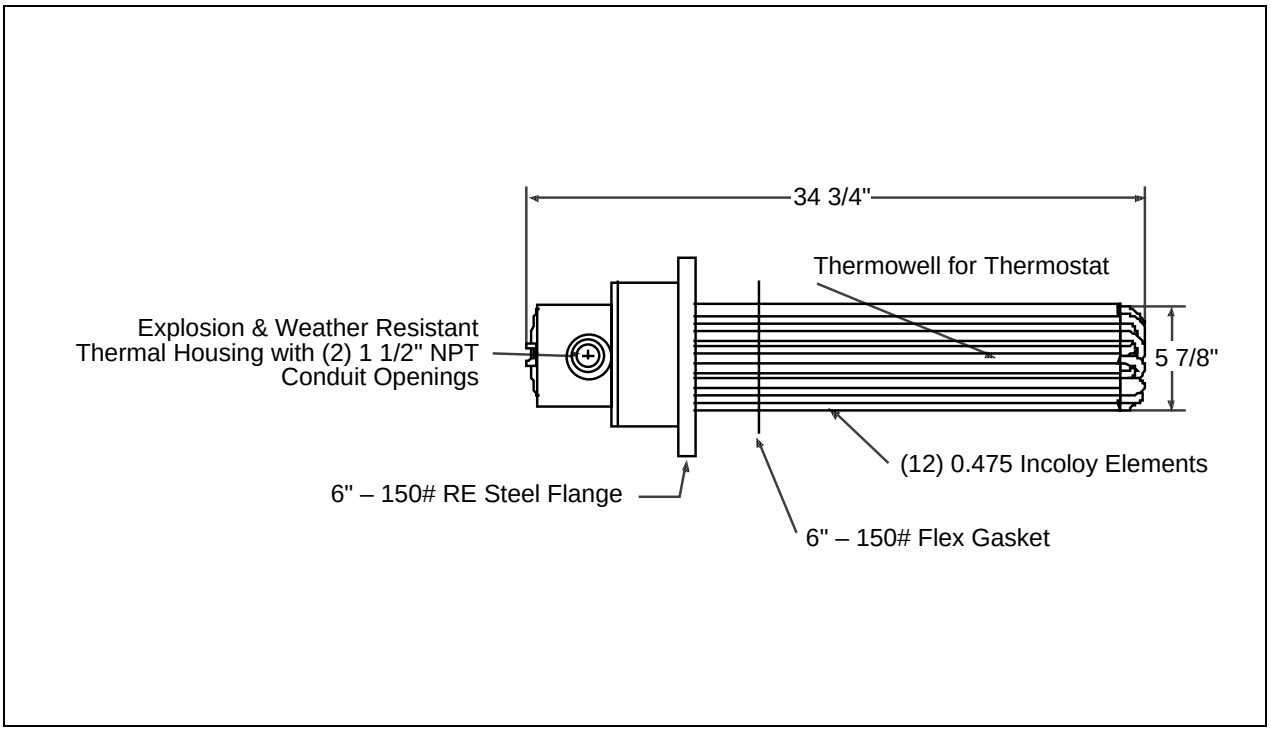


Figure 10 Blend Tank Immersion Heater

Blend Tank Agitator

Each of the Blend Tanks is equipped with a top-mounted, 2-blade, 29 inch agitator driven by a 1200 rpm ,1.0 horsepower (hp), explosion proof motor. The Blend Tank Agitators are powered from MCC 3 Cubicle 4C/5C and rotate at a speed of 45 rpm. There is a 25:1 reduction ratio from the motor speed to the agitator speed (minus the motor slip).

Blend Tank Transfer Pumps

The two (2) Blend Tank Transfer Pumps are ANSI, horizontal, centrifugal pumps with double mechanical seals and forced circulation barrier fluid systems. Each of the transfer pumps is designed for 60 gpm at 196 ft. tdh or approximately 90 psig. The pumps are driven by 7.5 hp explosion proof motors. Electrical power to the pumps is supplied from MCC 3 Cubicles 2L/1G.

The pumps and their associated motors are mounted on a drip rim baseplate. Casing drains and baseplate drains are piped (separately) to the drainage trench in the regulated portion of the Tank Farm diked area. The pumps are located on elevated pedestals in the center section of the Tank Farm Diked Area as shown on Figure 2.

Pump Seal System

The Pump Seal System associated with the centrifugal pump is the same for each of the liquid waste centrifugal pumps at the CIF that handle hazardous and/or radioactive wastes. Figure 11, *Pump Seal System,* provides a pictorial representation of the seal system for the pumps. Each of the pumps are equipped with double mechanical seals with a barrier fluid system. The barrier fluid is a 50%-50% mixture of water and ethylene glycol (anti-freeze), which is used to cool and lubricate the mechanical seals, to keep chemicals from leaking to the environment. The barrier fluid reservoir has a capacity of two gallons. Fluid can be added to the system via a removable cap. A sight glass is provided for a visual check of the barrier fluid. A nitrogen charging valve is installed on the top of the reservoir that will allow the addition of nitrogen into the reservoir.

The reservoir will be pressurized at 34 $\pm$ 2 psig (depending on the pump) after the reservoir and barrier fluid pipe lines have been charged with barrier fluid. A pressure gauge will be provided for reading reservoir pressure. A pressure switch is provided to measure pressure in the reservoir. Low pressure will stop the pump which in turn will actuate an alarm in the DCS. A level switch is provided to measure the level of the barrier fluid in the reservoir. Low level will stop the pump which in turn will actuate an alarm in the DCS. Note, that in both cases, it is not the pressure switch or level switch that actuates the alarm in the DCS; but rather, the stopping of the pump.

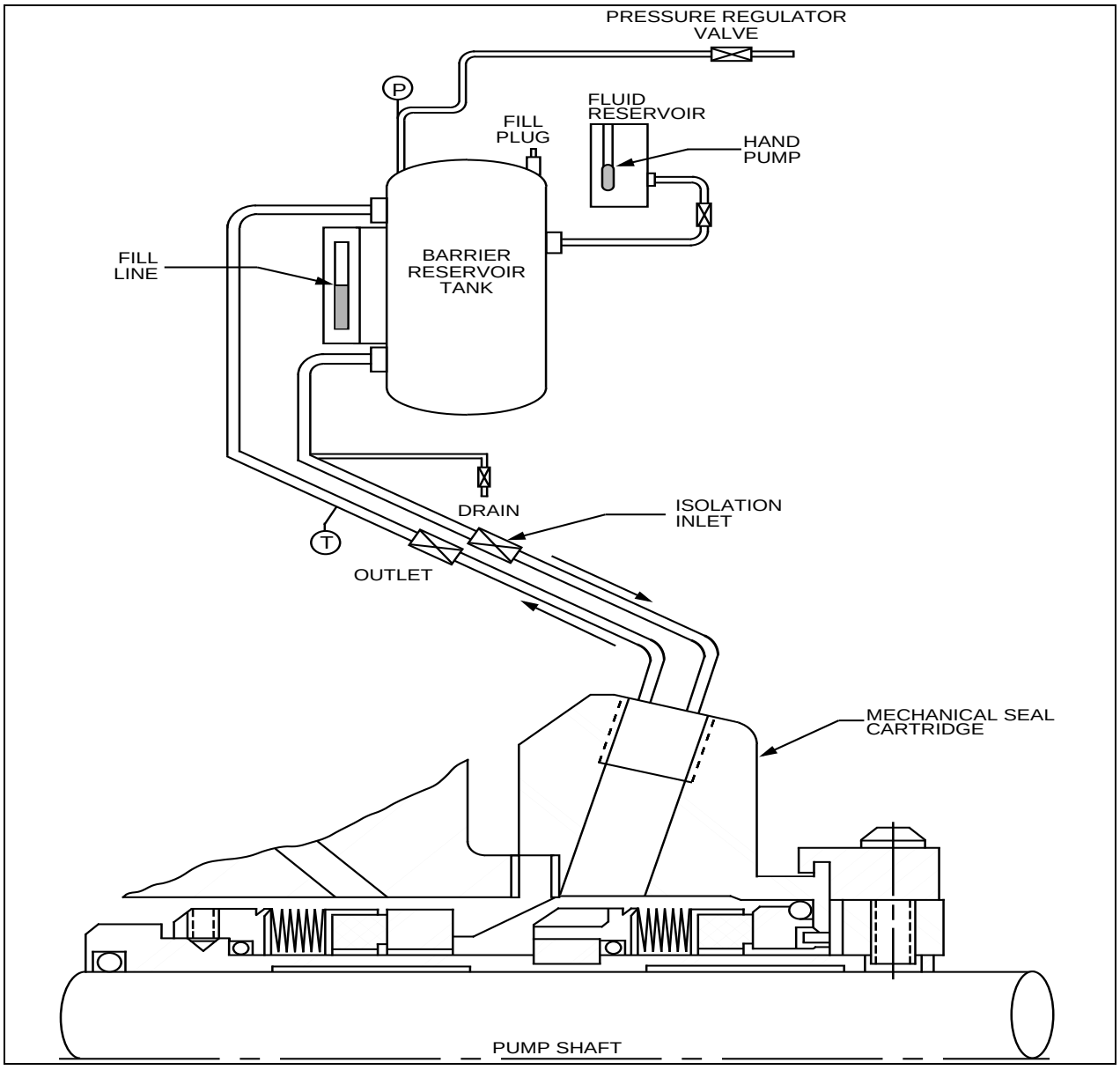


Figure 11 Pump Seal System

Blend Feed Pump

The Blend Feed Pump is a Milton Roy HPD (High Performance Diaphragm) Metallic Liquid End Metering pump. It is a 3/4 hp, constant speed, variable stroke, positive displacement pump. It is rated at 53 gph at a discharge pressure of 62 psig. Flow to the RK Waste Liquid Burner is DCS controlled by adjustment of the pump stroke. Back Pressure Valve PV-1612 is used to maintain a minimum back pressure of 40 psig on the discharge of the Blend Feed Pump. The back pressure is needed to assist in stabilizing the flow from the Blend Feed Pump.

The HPD Liquid End is particularly suitable for pumping costly, aggressive (caustic or acid) or other hazardous liquids without leakage. The diaphragm is hydraulically balanced between the process liquid on one side and the hydraulic oil on the other side. The hydraulic oil takes the place of a mechanical connection between the pump plunger and diaphragm. See Figure 12, *Liquid End Diaphragm Pump*.

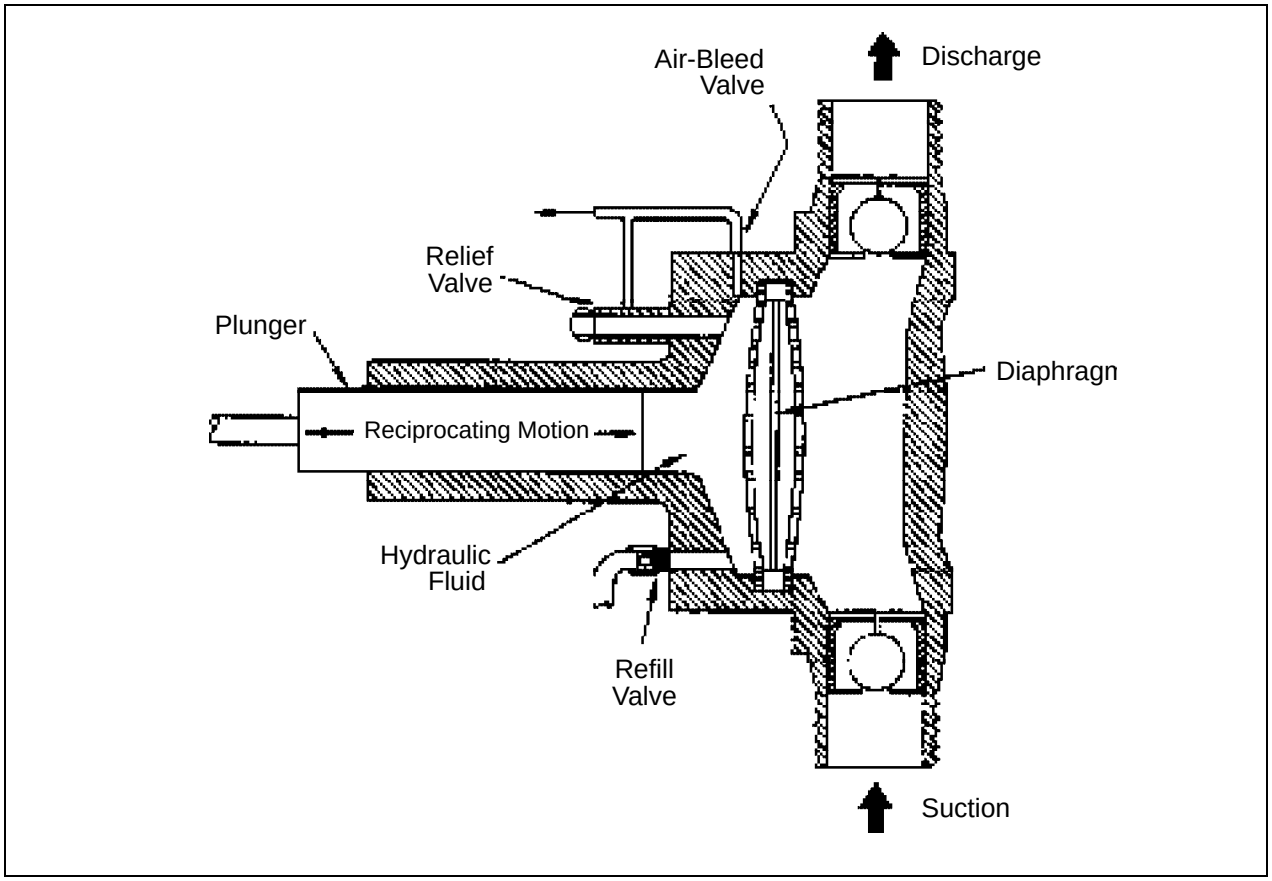


Figure 12 Liquid End Diaphragm Pump

The Blend Feed Pump is located on the RK Remote Burner Skid. Power to the feed pump is supplied from MCC 4 Cubicle 4A. The positive displacement feed pump also utilizes a pulsation dampener to minimize flow irregularities caused by the pump strokes. See Figure 13, *Pulsation*

Dampener.

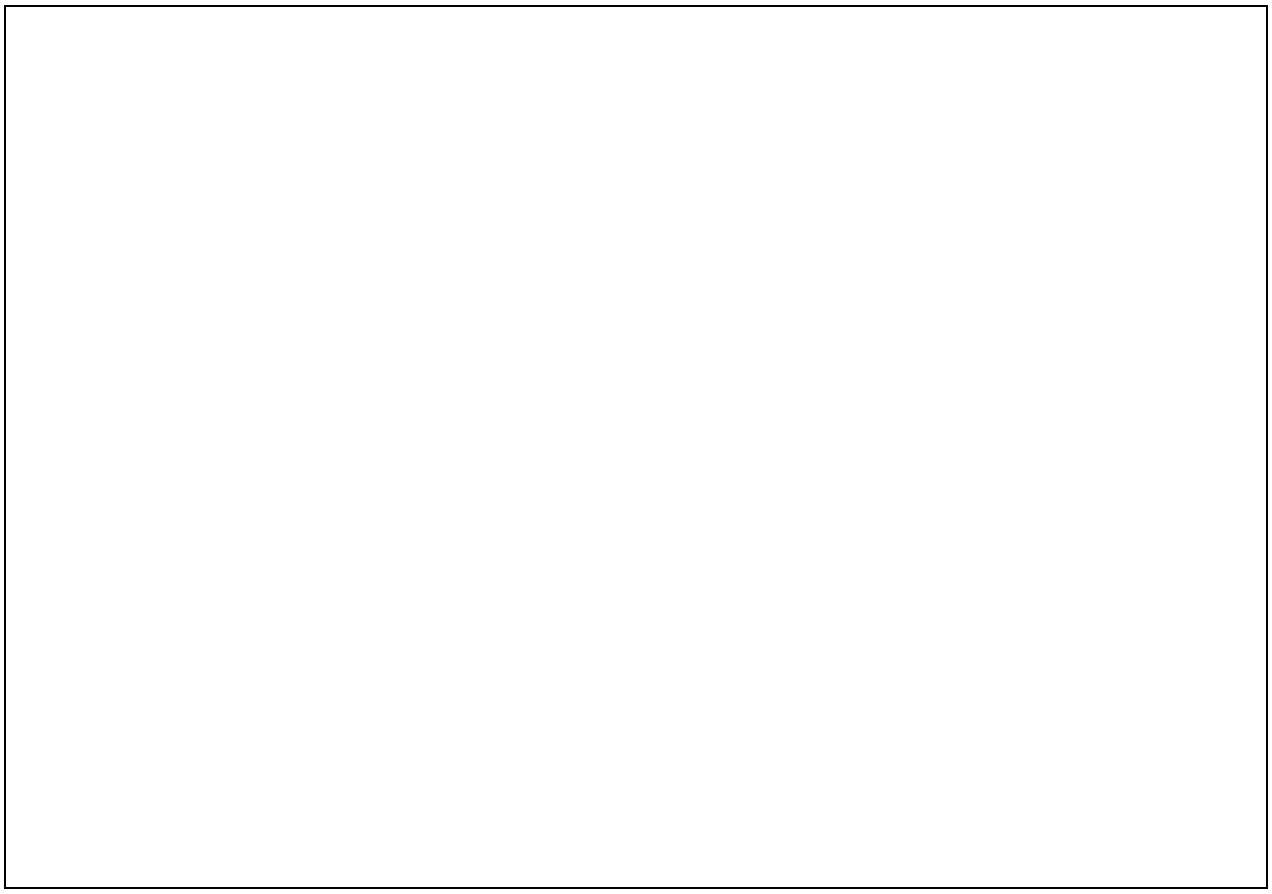


Figure 13 Pulsation Dampener.

RK Waste Liquid Burner

The RK Waste Liquid Burner is a long flame, gun-type burner designed for incineration of high heating value waste in the range of 7500 Btu/lb to 18,400 Btu/lb. It is capable of passing particulate up to 1/16 inch in diameter and has a turndown ratio of 4:1. Turndown ratio is nothing more than the ability to decrease flow through the burner, from maximum to minimum, without the flame becoming unstable. In this case, the maximum flow through the burner is 385 lb/hr with a minimum flow of 96 lb/hr. Atomizing steam is used to provide burner cooling, atomization of the Blended Waste, and to improve flame pattern to ensure complete burning of waste. Atomizing steam to the Burner is controlled at a constant 120 psig (Minimum of 115 psig by permit requirements).

RK Burner Skids

The RK Remote Burner Skid is located near the Burner Management Control Panel, outside the ram feed area on the RK Mezzanine. It contains the Blend Feed Pump and the atomizing steam pressure reducing valves. The RK Local Burner Skid is located adjacent to the ram feed near the RK feed head on the RK Mezzanine. The local skid contains the on/off (stop) valves for the

Blended Waste feed and atomizing steam to the burner.

Pneumatically Operated Valves

The supply valves associated with the Blend Tanks are pneumatically-operated valves, which are controlled through the DCS. Table 1, *Blended Waste System Pneumatic Valves*, lists the valves and their specific tank association with which system, and Figure 1 shows the valves within the system.

Valve Description	Blend Tank #1 Valve	Blend Tank #2 Valve
Fuel Oil Supply Valve	H-262-FO-LV-0314	H-262-FO-LV-0413
Inlet Valve from Spare Tank Transfer Pump	H-262-WTE-FV-0308	H-262-WTE-FV-0411
Inlet Valve from Rad Oils Pump	H-262- WTE-FV-0307	H-262- WTE-FV-0410
Inlet Valve from AQW Transfer Pump	H-262- WTE-FV-0309	H-262- WTE-FV-0400
Inlet from Blend Feed Pump Bypass	H-262- WTE-FV-0312	H-262- WTE-FV-0409
Discharge to Spare Tank	H-262- WTE-FV-0318	H-262- WTE-FV-0418
Discharge to Blend Feed Pump	H-262- WTE-FV-0311	H-262- WTE-FV-0408

Table 1 Blended Waste System Pneumatic Valves

Summary

- Blend Tank No. 1 and No. 2 are 4,200 gallon carbon steel vessels.
- The loop seal will withstand 2.38 psig positive pressure before it overflows and will collapse at 2.38 psig negative pressure. The rupture disc is designed to break at 1.5 psig positive pressure and to withstand a minimum pressure of 2.50 psig negative pressure.
- Each of the Blend Tanks is equipped with a top-mounted, 45 rpm, 2-blade agitator driven by a 1.0 hp explosion proof motor.
- The immersion heaters will maintain the contents of the Blend Tanks between 47˚F and 57˚F.
- The two (2) Blend Tank Transfer Pumps are (Worthington) ANSI, horizontal, centrifugal pumps with double mechanical seals and forced circulation barrier fluid systems. Each of the transfer pumps is designed for 60 gpm at 196 ft. tdh or approximately 90 psig.
- Each of the pumps are equipped with double mechanical seals with a barrier fluid system. The barrier fluid is a 50%-50% mixture of water and ethylene glycol (anti-freeze), which is used to cool and lubricate the mechanical seals, to keep chemicals from leaking to the environment.
- The Blend Feed Pump is a Milton Roy HPD (High Performance Diaphragm) Metallic Liquid End Metering pump. It is a 3/4 hp, constant speed, variable stroke, positive displacement pump. It is rated at 53 gph at a discharge pressure of 62 psig.
- The RK Remote Burner Skid is located near the Burner Management Control Panel, outside the ram feed area on the RK Mezzanine. It contains the Blend Feed Pump and the atomizing steam pressure reducing valves.
- The local skid contains the on/off (stop) valves for the Blended Waste feed and atomizing steam to the burner.
- The RK Waste Liquid Burner is a (John Zink) long flame, gun-type burner designed to introduce high heating value waste in the range of 7500 Btu/lb to 18,400 Btu/lb for incineration in the RK. It is capable of passing particulate up to 1/16 inch in diameter and has a turndown ratio of 4 to 1.
- The supply valves associated with the Blend Tanks are pneumatically-operated valves controlled through the DCS.

INSTRUMENTATION

ELO 3.04	**DESCRIBE the following Blended Waste System instrumentation including, indicator location (local or Control Room) sensing points and associated instrument controls.** **a. Blend Tank level** **b. Blend Tank temperature** **c. Blended Waste Tanks nitrogen pressure** **d. Corrosion transmitter** **e. RK Blended Waste pressure** **f. RK Blended Waste steam flow** **g. RK Blended Waste steam pressure** **h. Blended Waste feed flow** **i. Blended Waste feed temperature**

Level (LT-0302 Blend Tank #1, LT-0400 Blend Tank #2) & Specific Gravity (XT-0302 #1, 0400 #2)

Blend Tank uncompensated level and specific gravity are measured by a bubbler tube arrangement which uses a nitrogen purge. Differential pressure transmitter LT-0302 (0400) measures tank uncompensated level. Differential transmitter XT-0302 (0400) measures specific gravity. The two signals are sent to the DCS which computes a level measurement that is compensated for density of the material.

Blended Waste Tank level is measured by a bubbler tube arrangement using a nitrogen supply. Nitrogen is used in the tank farm tanks because of the hazardous conditions existing with tank farm fluids. The bubbler tube level detector works on the principle of hydrostatic pressure. The tube extends from the top of the tank downward to a point where the walls of the tank begin the curvature forming the bottom head of the tank. The amount of nitrogen pressure necessary to force bubbles from the tip of the bubbler tube is proportional to the height of the liquid. Meaning that higher levels require higher nitrogen pressure. The nitrogen regulator valve automatically increases or decreases pressure to maintain a constant flow to the tube. The vertical tube is kept empty by the nitrogen pressure forcing out bubbles. The tip of the tube is usually notched or cut at an angle to allow a steady stream of bubbles rather than periodic bursts of large bubbles. This feature stabilizes level indication.

The system is initially set for sufficient nitrogen pressure to produce bubbles when level is at its maximum level. A decrease in tank level from this point would result in a lower hydrostatic pressure.

More nitrogen flow would result and the regulator valve would reduce the nitrogen pressure to maintain a constant flow. Figure 14, *Tank Level Instrumentation*, illustrates the arrangement of the bubbler tubes, differential pressure transmitters, and nitrogen supply. The differential pressure transmitters consist of a differential pressure detector and a transmitter. Differential pressure transmitter H-262-WTE-LT-0504 measures tank level, and differential transmitter H-262-WTE-XT-0504 measures specific gravity.

Tank Level Detection

The differential pressure detector senses the difference in pressure between the nitrogen pressure forcing the bubbles out of the tube (which is proportional to level), and the pressure on the top of the tank. Sensing the pressure on the top of the tank negates any effect of the nitrogen blanket on the level measurement. The blanket pressure increases the pressure associated with tank fluid level, and if not accounted for would result in indicated levels higher than actual and level indication would vary with nitrogen blanket pressure changes. The pressure associated with the level bubbler tube is fed to the HIGH pressure connection of the differential pressure transmitter and the blanket pressure is fed to the LOW pressure connection. As tank level changes the bubbler tube pressure changes affecting the measured differential pressure. This change in differential pressure causes the output signal from the transmitter to vary proportional to level.

Density Compensation

The output from the level transmitter must be compensated for the density of the fluid being measured. Measuring two fluids with different densities and the same height would produce different pressures sensed by the differential pressure transmitter. Even though the actual height of the fluids were the same the output indication would differ. Also, heating the tank contents would cause the contents to expand forcing the level to increase. The pressure sensed by the detector would be the same even though the height has changed so level indication would not change.

The function of the density transmitter is to compensate the output of the level transmitter in accordance with the following relationship.

$$Level = \frac{\text{Pr}\ essure}{Density}$$

Where:

Level = the Actual Tank level

Pressure = the pressure from the height of fluid in the tank

Density = the density of the fluid in the tank (note: If temperature rises, then density decreases and vice-versa.)

Now, if the temperature of the fluid in the tank increased a constant pressure would be measured due to the height of fluid. Heating the fluid caused its density to decrease resulting in the level indication increasing with the actual level.

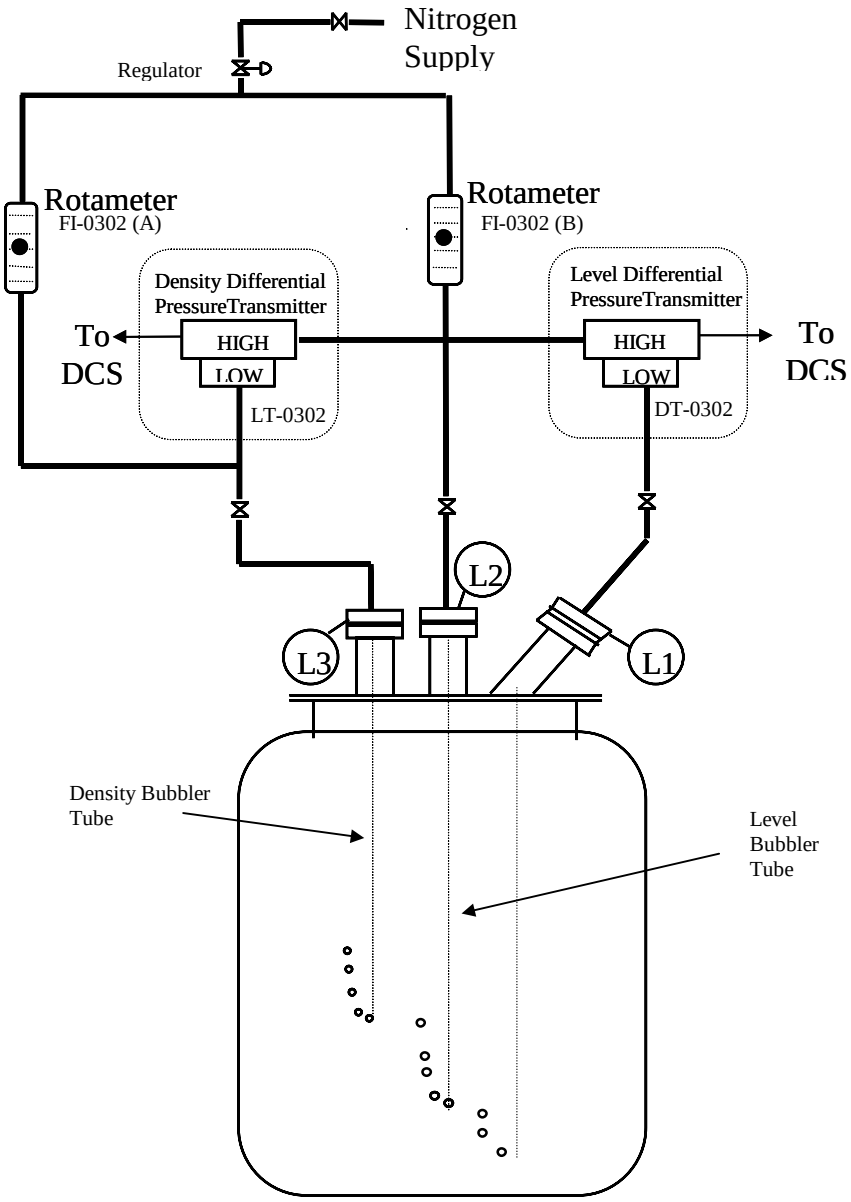
Assume a tank at 68°F has a level of 120 inwc, which corresponds to 4.33 psig and a specific gravity of 1. The tank contents is now heated to 200°F, the heating of the tank causes the fluid to expand and the density decreases. The density of the fluid at 200°F is now 0.9539. What is the new level in the tank. Indicated level would not change since the pressure of the water would be the same. The pressure is the same because we did not add or remove any mass from the tank. Using the above equation however the new level can be determined as follows:

The density signal is produced by measuring the difference in pressure between the level bubbler tube and the density bubbler tube. The tips of the tubes are at different heights in the tank. See Figure 14, *Tank Level Instrumentation*. Density transmitter HIGH pressure connection is connected to the level bubbler tube and LOW pressure connection is connected to the shorter density bubbler tube. The difference in pressure sensed by the density transmitter will only be affected by changes in density of the fluid. The two signals are sent to the DCS which computes a compensated level measurement. The DCS calculates and displays actual tank level by dividing the uncompensated tank level input by the density input. The DCS also displays the specific gravity of the tank contents. Specific gravity is a ratio of density of the fluid measured to the density of water. A specific gravity measurement of > 1.0 means that the fluid is heavier (more dense) than water and a specific gravity > 1.0 means that the fluid is lighter (less dense) than water.

The DCS produces level indication, specific gravity indication, interlocks and alarms for the DCS. The level indicator can only indicate levels above the tip of the bubbler tube and specific gravity indication only for levels above the shorter bubbler tube. At the LOW-LOW level, the then current specific gravity input to the DCS is locked and is utilized by the DCS for density compensation until level reaches the reset of the LOW-LOW level switch. This is done to ensure level indication is available at low tank levels which can uncover the tip of the density bubbler. Level measurement cannot be made at levels below the tip of the level bubbler tube. Actual level indication is provided with a range of 20-170 INWC. Blended Waste Level Transmitters H-262-WTE-LT-0302/0400, have a range of 3.6-153.6 INWC. Specific Gravity indication is provided with a range of 0.6-1.6 unitless (Specific gravity is a ratio of the unknown liquids density to that of water and therefore has no units). These instruments provide level indication, specific gravity indication, interlocks and alarms for the DCS. On LOW-LOW level, the then current specific gravity input to the calculation is utilized by the DCS until cleared by a reset of the LOW-LOW level. DCS alarms are provided for the following tank levels:

DCS Alarms are provided for the following:

- LOW Level at 45.5 inches.
- LOW-LOW Level at 39.5 inches.
- LOW-LOW-LOW Level at 32 inches
- HIGH Level at 134 inches.
- HIGH-HIGH Level at 140 inches (Soft switch).
- HIGH-HIGH-HIGH Level at 140 inches (Mechanical float hard switch).



Note: All CLI numbers are preceded with ***H-262-WTE-***

Figure 14 Tank Level Instrumentation

Blend Tank Temperature (TT-0305 #1, TT-0404 #2)

Note: All CLI numbers are preceded with **H-262-WTE-** unless otherwise noted. Blend Tank temperature is measured with a Resistance Temperature Detector (RTD) sensor and transmitter. The RTD provides input to the temperature transmitter which, in turn, provides an output to the DCS. DCS indication has a range of 30-170 °F. Blend Tank temperature is maintained between 47 °F and 57 °F by an 0n-off gap controller (H-262-WTE-TC-0305) for the immersion heater. Alarms are provided on the DCS for LOW-LOW temperature at 45 °F and HIGH-HIGH temperature at 120 °F.

Blend Tank Nitrogen Pressure

The Blend Tank nitrogen pressure is monitored to ensure proper tank blanketing and to ensure tank integrity. Pressure indication is a local gage only, there is no actual tank pressure indication on the DCS. The following DCS indications/alarms are associated with Blend Tank pressure: (Note: All CLI numbers are preceded with **H-262-WTE-** unless otherwise noted.)

- HIGH-HIGH Pressure switch (PS-0315 #1, PS-0402 #2) provides a DCS Alarm (0315-PA #1, 0402-PA #2) at 1.5 psig 41.5 inwc.
- HIGH Pressure switch (PS-0313 #1, PS-0412 #2) provides a DCS Alarm (0313-PA-1 #1, 0412-PA-1 #2) at 1.25 psig or 34.6 inwc.
- LOW pressure switch (PS-0313 #1, PS-0412 #2) provides a DCS Alarm (0313-PA #1, 0412-PA #2) at -0.1 psig or -2.8 inwc.

Corrosion Transmitter

The Blend Tanks are each equipped with an electrical resistance probe which is exposed to the potentially corrosive environment in the tanks. The corrosion transmitter converts the probe corrosion (a function of increasing resistance) to a signal corresponding to a tank wall corrosion between 0 and 5 mils (a mil is .001 inches or a thousandth of an inch). The DCS calculates the rate of corrosion and displays it within the range of 0-60 mils/year (MPY). An alarm is provided on the DCS at 50 MPY/10 hours with the calculation performed every hour (H-262-WTE-AAH-0319/ H-262-WTE-AAH-0419). The corrosion probe has an effective probe life of 5 mils. 60 corrosion coupons are also inserted in a stack arrangement at three zones in the Blend Tanks, to simulate actual corrosion of the tanks. Three coupons will be pulled once a year for inspection purposes. If a High Corrosion alarm is received, this indicates a potentially corrosive mixture, and then the corrosion coupons will be pulled and inspected.

RK Blended Waste Pressure

The pressure to the RK Waste Liquid Burner is measured by pressure transmitter PT-1605 on the RK remote skid, which provides a DCS indication with a range of 0-200 psig. Local indication is provided on the RK Remote Burner Skid by BRW-PI-1602 and BRW-PI-1611. See Figure 15, *Diaphragm Seal Pressure Gage.*

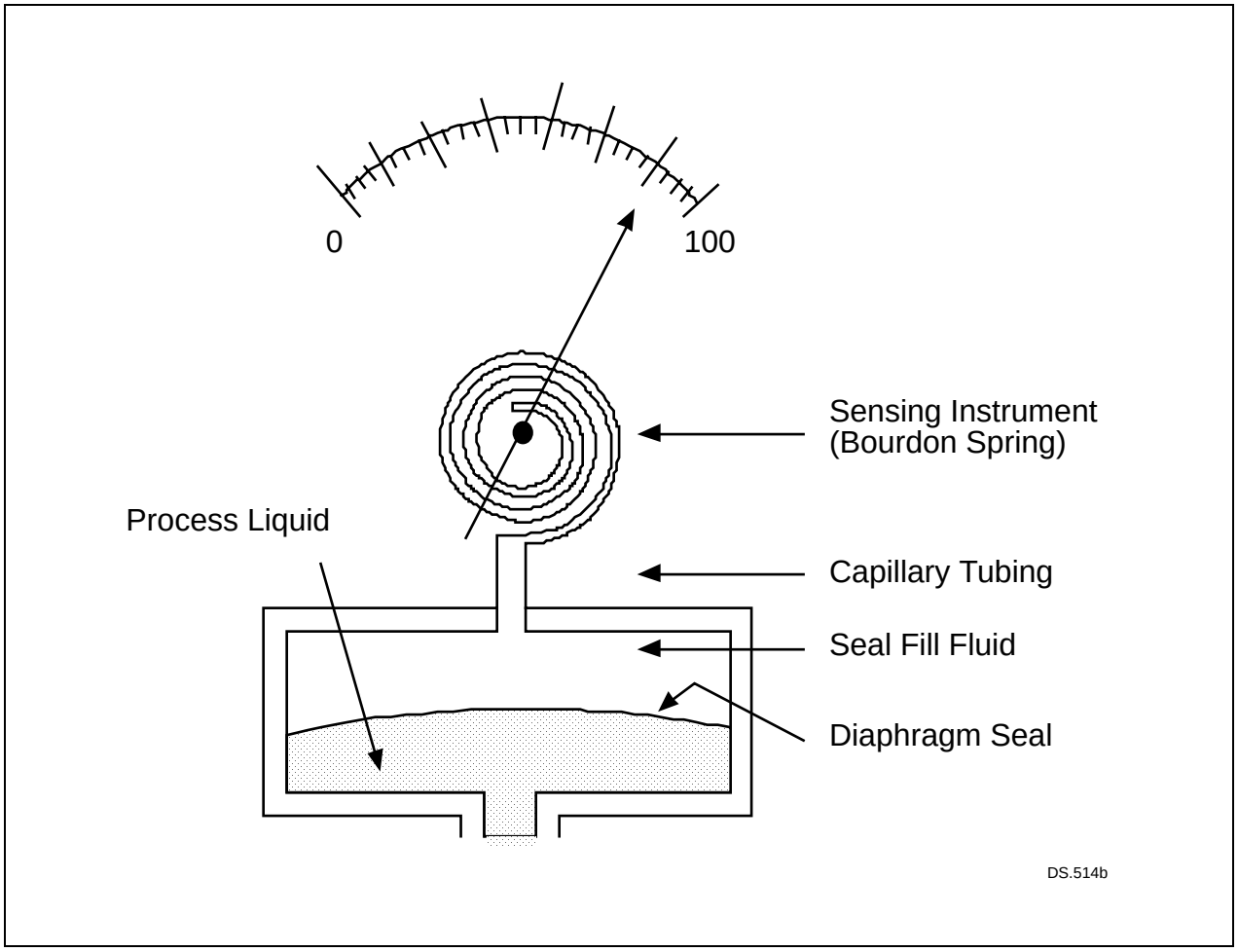


Figure 15 Diaphragm Seal Pressure Gage

RK Blended Waste Steam Flow

Steam flow to the RK Waste Liquid Burner is measured by DP flow transmitter H-261-MS-FT-1601 on the RK remote skid, which provides a DCS indication with a range of 0 to 200 lb/hr.

RK Blended Waste Steam Pressure

The steam pressure to the RK Waste Liquid Burner is measured by pressure transmitter PT-1604 which provides a DCS indication with a range of 0-200 psig. Local indication is provided on the RK Remote Burner Skid by H-261-MS-PI-1606.

Blended Waste Feed Flow

Blend Feed flow to the RK Burner is measured by a Coriolis mass flowmeter, (See Figure 16, *Mass Flowmeter*) H-261-BRW-FT-1600, on the RK remote skid. Local indication is provided by H-261-BRW-FI-1600. A signal is sent to the DCS which is used for indication (0-400 lb/hr) and also as input into the Feed Controller and DCS Alarm "HIGH Flow Liquid Waste."

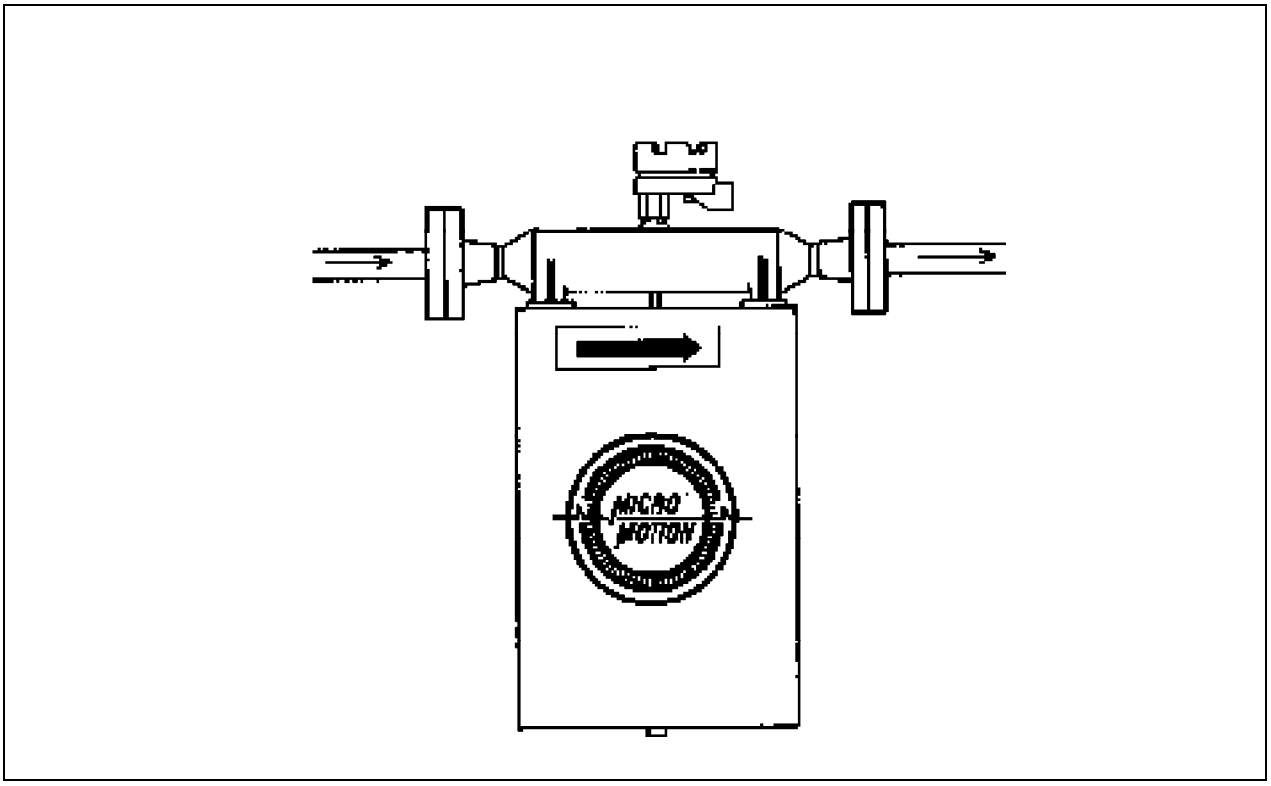


Figure 16 Mass Flowmeter

The purpose of Mass Flow Transmitter H-261-BRW-FT-1600 is to measure the flowrate from the Blended Waste Feed Pump. Power for the flow transmitter is supplied from Instrument Power Panel D.

Installed downstream of the filter, the flow sensor measures the amount of twist produced from flow through a U-shaped sensing tube. Figure 17, *Operating Principle of Coriolis Mass Flowmeter*, depicts this flow induced twisting force. The amount of twist is measured by magnetic position detectors which provide an input signal to the flow transmitter. The measured flow signal is essentially unaffected by variations in fluid properties, such as viscosity, pressure, temperature, pulsations, entrained gases, and suspended solids.

The flow transmitter sends an electrical signal for local (H-261-BRW-FI-1600) and remote (DCS, H-261-BRW-FIC-1600) flow rate indication.

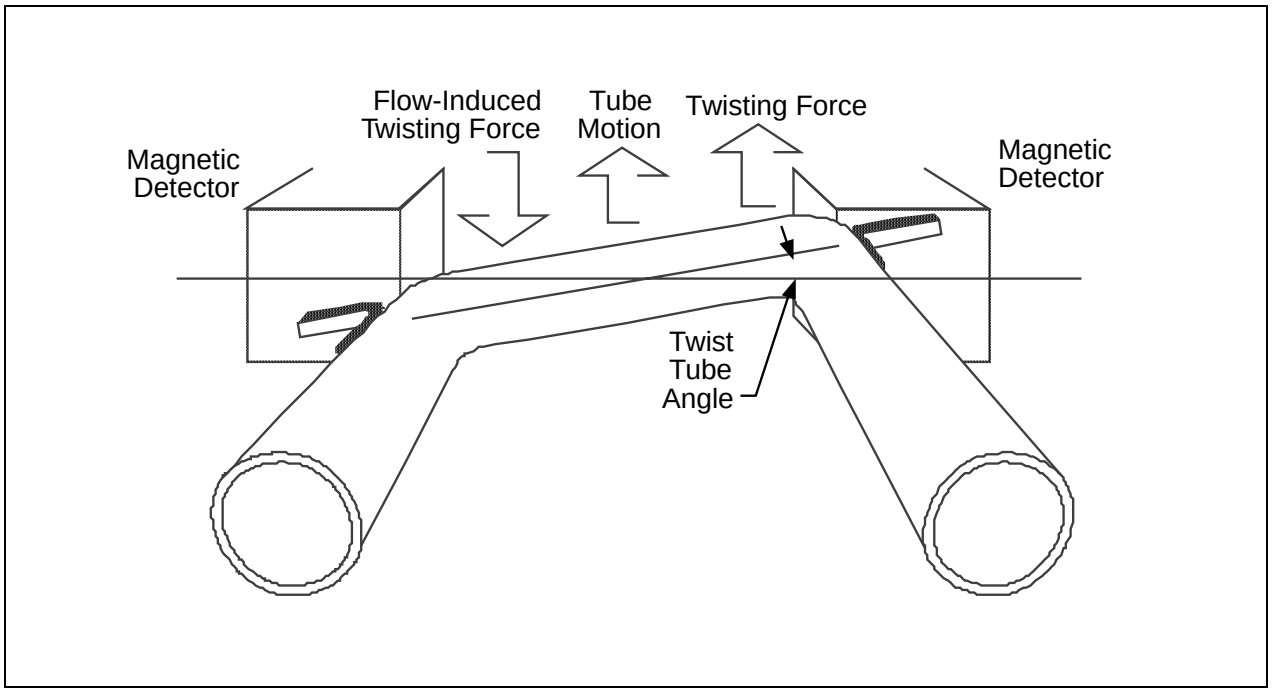


Figure 17 Operating Principle of Coriolis Mass Flowmeter

Blended Waste Feed Temperature

Blended Waste Feed Temperature is measured by temperature indicator H-261-BRW-TI-1608 and provides local indication on the RK Remote Burner Skid by H-261-BRW-TI-1608.

Other DCS indications include the following:

- Blended Waste Transfer Pump Run Status
- Blended Waste Transfer Pump Field Start
- Blend Tank Agitator Status
- Blend Tank Agitator Field (local) Start
- Blend Tank 1 to Spare Tank valve position indication.
- Blend Tank 2 to Spare Tank valve position indication.

Summary

- Blend Tank uncompensated level and specific gravity are measured by a bubbler tube arrangement which uses a nitrogen purge.
- Blend Tank temperature is measured with a Resistance Temperature Detector (RTD) sensor and transmitter.
- The Blend Tank nitrogen pressure is monitored to ensure proper tank blanketing and to ensure tank integrity.
- The Blend Tanks are each equipped with an electrical resistance probe, which is exposed to the potentially corrosive environment in the tanks.
- The pressure to the RK Waste Liquid Burner is measured by pressure transmitter H-261-BRW-PT-1605 which provides a DCS indication with a range of 0-200 psig.
- Steam flow to the RK Waste Liquid Burner is measured by DP flow transmitter H-261-MS-FT-1601 which provides a DCS indication with a range of 0 to 200 lb/hr.
- The steam pressure to the RK Waste Liquid Burner is measured by pressure transmitter H-261-MS-PT-1604 which provides a DCS indication with a range of 0-200 psig.
- Blend Feed flow to the RK Waste Liquid Burner is measured by mass flowmeter H-261-BRW-FT-1600.
- Blended Waste Feed Temperature is measured by temperature indicator H-261-BRW-TI-1608 and provides local indication on the RK Remote Burner Skid.

CONTROLS, INTERLOCKS AND ALARMS

ELO 3.06	**EXPLAIN how the following Blended Waste System equipment is controlled in all operating modes or conditions to include: control locations (local or Control Room), basic operating principles of control devices, and the effects of each control on the component operation.** **a. Blended Waste Transfer Pumps** **b. Blend Tank Agitators** **c. Tank Temperature Control** **d. Blended Waste Feed Pump**
ELO 3.07	**DESCRIBE the interlocks associated with the following Blended Waste System equipment to include the interlock actuating conditions, effects of interlock actuation, and the reason the interlock is necessary.** **a. Blend Tank Immersion Heaters** **b. Blend Tank Agitators** **c. Blend Tank Transfer Pumps** **d. Blend Tank Transfer Pumps Discharge Valves** **e. Blend Tank Valve to Spare Tank**

Controls

Blended Waste Transfer Pumps

The Blended Waste Transfer Pumps are controlled through the DCS via a Start/Stop Push-button (PB-0316 #1 and PB-0414 #2) on DCS point tag WTE0316/0414E-1. They may also be started and stopped locally for testing using the local MOA station.

Blend Tank Agitators

Start/Stop Push-buttons PB-0301 #1 and PB-0405 #2 (D1/D2) are provided on the DCS for operation of the Blend Tank Agitators using DCS point tag WTE0301E-1. In addition, the agitators may be started and stopped locally using the local MOA station.

Tank Temperature Control

Blend Tank temperature is automatically controlled through the DCS. Blend Tank temperature is maintained between 47 °F and 57 °F by an 0n-off gap controller (H-261-WTE-TC-0305) for the immersion heater. The immersion heater comes on it 47 ˚F decreasing tank temperature and turns off at 57 ˚F increasing tank temperature. Alarms are provided on the DCS for LOW-LOW temperature at 45 °F and HIGH-HIGH temperature at 120 °F.

RK Blended Waste Feed Pump

The Blend Feed Pump is controlled through the DCS by a controller. Controller H-261-BRW-FC-1600 controls the stroke of the metering pump to ensure flow to the RK is correct with respect to RK Temperature and the setpoint.

Interlocks

Blend Tank Immersion Heaters

These interlock conditions will prevent unsafe operation of the immersion heater. The logic associated with the Blend Tank heaters is depicted on CIF Tank Farm Logic Diagram Sheet 4 Instruments, SE5-2-2006178 for Blend Tank #1 Heater and CIF Tank Farm Logic Diagram Sheet 6 Instruments, SE5-2-2006180 for Blend Tank #2 Heater. The following conditions must exist to energize the heater:

- Temperature at or below DCS controller setpoint.
- Blend Tank N2 Pressure not low.
- Blend Tank N2 Pressure not high-high (If pressure is high, heating the tank will only increase the pressure more).
- Blend Tank Level not low-low-low (Prevent uncovering heater).

Blend Tank Agitators

These interlock conditions will prevent unsafe operation of the agitator. The logic associated with the Blend Tank Agitators is depicted on CIF Tank Farm Logic Diagram Sheet 4 Instruments, SE5-2-2006178 for Blend Tank Agitator #1 and CIF Tank Farm Logic Diagram Sheet 6 Instruments, SE5-2-2006180 for Blend Tank Agitator #2. The following conditions must exist to start the agitator:

- Blend Tank N2 Pressure not low (Prevent running pump or agitator, which would further lower nitrogen pressure).
- Blend Tank N2 Pressure not high-high (Possible chemical reaction needs no additional mixing)
- Blend Tank Level not low-low-low (Agitator flow stabilizer uncovered).
- START selected on DCS or the local MOA.

Blend Tank Transfer Pumps

These interlock conditions will prevent unsafe operation of the transfer pump. The logic associated with the Blend Tank Transfer Pumps is depicted on CIF Tank Farm Logic Diagram Sheet 19 Instruments, SE5-2-2006265 for Blend Tank #1 Transfer Pump and CIF Tank Farm Logic Diagram Sheet 21 Instruments, SE5-2-2006267 for Blend Tank #2 Transfer Pump. The following conditions must exist to start the pump:

- Blend Tank N2 pressure not low.
- Blend Tank level not low-low-low.
- Blend Tank N2 pressure not high-high.
- Supply valves from AQW System, Fuel Oil Transfer Pump, Rad Oils System, and Spare Tank closed(Prevent pumping out of and into a tank at the same time).
- Blended Waste Transfer Pump discharge to Blend Feed Pump valve closed (Don't want to send flow to feed pump inadvertently).
- Blended Waste return from Blend Feed Pump valve closed.
- Blend Tank discharge to Spare Tank valve closed(Ensures that Spare Tank is not inadvertently filled).
- START selected on DCS or the local MOA.

As previously mentioned, the transfer pumps are normally used to pump contents from the associated tank (i.e. pump #1 and tank #1, pump #2 and tank #2). It is possible to align the pumps to the opposite tank. It is important to note that when aligned to the opposite tank, the interlocks for the associated valves are essentially bypassed. So, it would be possible to pump from the tank while waste was being transferred into the tank, or to overflow the tank. It is vital that this be understood (See Figure 1).

Blend Tank Transfer Pumps Discharge Valves

These interlock conditions will prevent unsafe operation of the Blend Tank Transfer Pumps Discharge Valves. The logic associated with the Blended Waste Transfer Pump discharge to Blend Feed Pump valve and the Blend Tank and the Blended Waste return from Blend Feed Pump valves is depicted on CIF Tank Farm Logic Diagram Sheet 19 Instruments, SE5-2-2006265 for both Blend Tank #1 and Blend Tank #2. The following condition must exist to open these valves:

- Blend Tank temperature not low-low (Possible improper viscosity).
- RK Waste Liquid Run Command permissive from Burner Management System (If you don't have the feed permissives, then you don't need the discharge valves open).
- Associated Blended Waste Transfer Pump running or activated via DCS or the local MOA station (You don't want these valves open if there is no flow/pump running).

Blend Tank Valve to Spare Tank

These interlock conditions will prevent unsafe operation of the Blend Tank valves to the Spare Tank. The logic associated with the Blend Tanks Valves to the Spare Tank is depicted on CIF Tank Farm Logic Diagram Sheet 28 Instruments, W2017842 for Blend Tank #1 and CIF Tank Farm Logic Diagram Sheet 29 Instruments, W2017843 for Blend Tank #2. The following conditions must be met to open these valves (See Table 2 *Blend Tank Discharge to Spare Tank*):

• Blend Tank temperature not low-low.	• Spare Tank Nitrogen pressure not low.
• Spare Tank Nitrogen pressure not high-high.	• Spare Tank level not high-high.
• Spare Tank level not high-high-high.	• Rad Oils Valve to Spare Tank closed.
• Regulated Sump valve to Spare Tank closed.	• AQW Tank valve to Spare Tank closed.
• Other Blend Tank valve to Spare Tank closed.	• Spare Tank valve to AQW Tank closed.
• Spare Tank valve to Blend Tank #1 closed.	• Spare Tank valve to Blend Tank #2 closed.
• Blend Tank Transfer Pump Discharge to Blend Feed Pump valve closed.	• Blend Feed Pump return Blend Tank valve closed.
• Blend Tank being transferred level not low-low-low.	• No combustible gases detected in Tank Farm, Tank Farm Stack, or in Incinerator Area.
• Associated Blended Waste Transfer Pump running or activated via DCS or the local MOA station.	

Table 2 Blend Tank Discharge to Spare Tank

Limits

Permit limitations associated with the Blended Waste System or Blended Waste Operations in the CIF are as follows:

- Maximum flow rate from either Blend Tank to the RK is 385 lb/hr.
- Minimum BTU content for Blended Waste is >7500 btu/lbm.
- Tanks will only be filled to 90% of capacity.
- Laboratory compatibility tests will be performed prior to every addition to a tank/container, unless the tank/container contains the same material as the waste being added, process knowledge demonstrates the waste being added is compatible with the waste in the tank, or the tank is empty.
- Each batch of liquid or waste blend accumulated in one of the CIF waste storage tanks will be analyzed before the waste is pumped to the incinerator.
- Waste Feed Cutoff Interlocks will be tested daily, weekly, and monthly, when in mode 1 feed operations at the CIF.
- Minimum steam pressure of 115 psig supplied to atomizing steam valve, which opens when temperature is above 1000 ˚F to maintain nozzle temperature within design limits.

ELO 3.05	**INTERPRET the following Blended Waste System alarms, including the conditions causing alarm actuation and the basis for the alarms:** **a. Blend Tank level** **b. Blend Tank temperature** **c. Blend Tank nitrogen pressure** **d. Blend Tank corrosion** **e. RK Blended Waste pressure** **f. RK Blended Waste steam flow** **g. RK Blended Waste steam pressure** **h. Blended Waste feed flow** **i. Blended Waste feed temperature**

Setpoints

(See Table 3**,** *Blended Waste Setpoints)*

DRAWING NUMBER	CLI NUMBER	ALARM	SETPOINT
W830307/ W830308	H-262-WTE-LAL-0302/0400	Blend Tank #1&#2 Level Low	45.5 inches
W830307/ W830308	H-262-WTE-LAH-0302/0400	Blend Tank #1 Level High	134 inches
W830307/ W830308	H-262-WTE-LAHH-0302/0400	Blend Tank #1 Level High-High	140 inches
W830307/ W830308	H-262-WTE-LAHH-0300/0401	Blend Tank #1 & #2 Level High-High-High	140 inches
W830307/ W830308	H-262-WTE-TALL-0305/0404	Blend Tank #1& #2 Temperature Low-Low	45 °F
W830307/ W830308	H-262-WTE-TAHH-0305/0404	Blend Tank #1& #2 Temperature High-High	105 °F
W830307/ W830308	H-262-WTE-PAL-0313/0412	Blend Tank #1& #2 N2 Pressure Low	0 inwc or -0.0 PSIG
W830307/ W830308	H-262-WTE-PAH-0313/0412	Blend Tank #1& #2 N2 Pressure High	1.25 PSIG or 34.6 inwc
W830307/ W830308	H-262-WTE-PAHH-0315-(A)/0402-(A)	Blend Tank #1& #2 N2 Pressure High-High	1.5 PSIG or 41.5 inwc
W830307/ W830308	H-262-WTE-AAH-0319/0419	Blend Tank #1& #2 High Corrosion	50 MPY/10 hours

Table 3 Blended Waste Setpoints

DRAWING NUMBER	CLI NUMBER	ALARM	SETPOINT
W830313	H-261-BRW-FAH-1600	RK WL Flow Rate High	385 lb/hr
W830313	H-261-MS-FAL-1601	RK WL Steam Flow Rate Low	20 lb/hr
W830313	H-261-BRW-PALL-1603	RK WL Pressure Low-Low	3 psig
W830313	H-261-MS-PAL-1604	RK WL Steam Pressure Low	90 psig
W830313	H-261-BRW-PAL-1605	RK WL Liquid Pressure Low	2.5 psig
W830313	H-261-BRW-PAH-1603	RK WL Pressure High	65 psig
W830313	H-261-MS-PAH-1610	RK WL Steam Pressure High	135 psig
W830313	H-261-BRW-FAH-1614	RK WL Pump Bypass Flow High	0.817 gpm
W830314	H-261-FD-FALL-1900	RK WL Comb Air Flow Low Low	1571 LB/HR
W830314	H-261-FD-FAL-1900	RK WL Comb Air Flow Low (25%)	1763 LB/HR
W830314	H-261-INC-BAL-1915	RK WL Scanner #1 Flame Failure	Flame Off
W830314	H-261-INC-BAL-1916	RK WL Scanner #2 Flame Failure	Flame Off
W830314	H-261-FD-FAL-1917	RK WL Comb Air Mass Flow Low	95%
W830314	H-261-INC-ZA-1920	RK WL Gun Position Failure	Actuates

Table 3 Blended Waste Setpoints (Cont.)

Summary

- The Blended Waste Transfer Pumps are controlled through the DCS via a Start/Stop Push-button (PB-0316 #1 and PB-0414 #2) on DCS point tag WTE0316/0414E-1. They may also be started and stopped locally for testing using the local MOA station.
- Start/Stop Push-buttons PB-0301 #1 and PB-0405 #2 (D1/D2) are provided on the DCS for operation of the Blend Tank Agitators using DCS point tag WTE0301E-1. In addition, the agitators may be started and stopped locally using the local MOA station.
- Blend Tank temperature is automatically controlled through the DCS. Blend Tank temperature is maintained between 47 °F and 57 °F by an 0n-off gap controller (H-261-WTE-TC-0305) for the immersion heater. The immersion heater comes on it 47 ˚F decreasing tank temperature and turns off at 57 ˚F increasing tank temperature. Alarms are provided on the DCS for LOW-LOW temperature at 45 °F and HIGH-HIGH temperature at 120 °F.
- The Blend Feed Pump is controlled through the DCS by a controller. Controller H-261-BRW-FC-1600
- Interlocks are used to prevent operation of critical equipment or components unless required conditions are met/satisfied.
- Limits are used to keep components operating within a safe range, thus ensuring safe operation of the Blended Waste System.

SYSTEM INTERRELATIONS

Aqueous Waste AQW System

The AQW System can supply waste to the Blend Tanks if the liquid has a caloric value greater than 5000 Btu/lb. This is done by using procedure 261-SOP-AQW-01.

DCS

As with most systems associated with the CIF, control of the Blend Tank System is accomplished through the DCS. Pump operation and selection of destination or receipt of waste are accomplished using the DCS. Blended Waste System operating parameters such as temperature, pressure, level and feed flow to the RK are all monitored by the DCS. In addition, tank temperature can be controlled between 50 °F and 150 °F by the DCS using the immersion heater.

Electrical Distribution System

Supplies electrical power to operate Blended Waste System components. Electrical power must be available to operate the BRW equipment in accordance with 261-SOP-ELNH-01, 480 Volt Power Electrical

Fuel Oil System

Supplies No. 2 fuel oil for mixing with other wastes in the Blend Tanks to increase the caloric content to the desired level. Also supplies fuel oil and the driving force, via the Fuel Oil Transfer Pump, for system flushing.

Instrument Air System

The Instrument Air System supplies air to pneumatically operated automatic valves.

Nitrogen System

The Nitrogen System supplies a blanket on the Blend Tanks to prevent the buildup of explosive vapors in the free space above the liquid in the tanks. In addition, the Nitrogen System supplies purge for the bubbler system used in waste tank level measurement. Finally, the Nitrogen System supplies a charging pressure to the reservoir for the Pump Seal System associated with the Blended Waste Transfer Pumps.

Rad Oils/Solvent Unloading (Rad Oils) System

The Rad Oils System is used to pump waste from tankers or other portable containers to a waste tank. The normal destination for waste pumped from the Rad Oils System is one of the Blend Tanks. This is accomplished by using procedure 261-SOP-WTE-03.

Spare Tank System

The Spare Tank System can supply waste to the Blend Tanks and can also receive waste from the Blend Tanks. The CIF must maintain spare capacity great enough to accommodate the waste tank with the most volume in the event of a leaking or failed tank event.

Tank Farm Automatic Sampler

The Automatic Sampler receives flow from many possible locations, one of which is the Blended Waste System, as indicated on Figure 4. The discharge of the sampler is then returned to the appropriate Blend Tank. This is accomplished by using procedure 261-SOP-WTE-04.

Waste Vent System

The Blend Tanks are vented to the Waste Vent System. This system directs any gases vented from the Blend Tanks through HEPA Filters and a Carbon Canister prior to elevated release via the Tank Farm Stack. The Waste Vent System is required to be in operation in accordance with 261-SOP-WV-01.

Heat Trace System

The Heat Trace System provides freeze protection for the Blend Tank associated piping and valves. Heat trace will be on at 50 ˚F decreasing and off at 50 ˚F increasing. The Heat Tracing System is required to be in operation in accordance with 261-SOP-HTTR-01.

Summary

- The AQW System can supply waste to the Blend Tanks if the liquid has a caloric value greater than 5000 Btu/lb.
- The DCS controls most aspects of the Blended Waste System.
- The Nitrogen System supplies a blanket on the Blend Tanks to prevent the buildup of explosive vapors in the free space above the liquid in the tanks.
- The Rad Oils System is used to pump waste from tankers or other portable containers to a waste tank
- The Spare Tank System can supply waste to the Blend Tanks and can also receive waste from the Blend Tanks in an emergency.
- The Automatic Sampler receives flow from many possible locations.
- The Blend Tanks are vented to the Waste Vent System.

INTEGRATED PLANT OPERATIONS

ELO 4.01	**Given applicable procedures and plant conditions, DETERMINE the actions necessary to perform the following Blended Waste System operations:** **a. Startup** **b. Normal Operation of Equipment** **c. Shutdown**

Normal Operations

Operations associated with the Blended Waste System are controlled per 261-SOP-BRW-01, *Blended Radioactive Waste Operations (U).*

With the exception of the Rad Oils/Solvents Unloading Pump, the waste tank transfer pumps may be started by the operator using the DCS. The Rad Oils Solvent Unloading Pump is started locally after it has been connected to a source. The valves (pneumatically operated) in the supply lines from other source are kept closed by the DCS during the transfer process. When the level in the Blend Tanks reaches the HIGH-HIGH point (140"), the DCS will stop the pump and close the associated valves.

Sampling Blend Tanks

The Blended Waste shall be recirculated and agitated for the minimum time required to recirculate one (1) volume of the existing Blend Tank. This is accomplished by taking the current tank level and multiplying by 31.33 gallons per inch, to obtain the volume to be recirculated prior to sampling. Now you divide your recirculation volume by the Blend Transfer Pump recirculation flow of 3600 gph. Here is an example to illustrate this calculation.

Current Blend Tank Level = 128.5 inches
X 31.33 gallons per inch = 4025.9 gallons
÷ 3600 gph recirculation flow = 1.12 hours of recirculation required prior to sampling.

Adding Waste to a Blend Tank

Prior to adding any waste to a Blend Tank, nitrogen pressure in the Blend Tank must be between LOW and HIGH-HIGH. Next, the level of the target tank is verified to have sufficient free volume to accept the transfer. The third item checked before any transfer is that no combustible gas is detected in the Incinerator or Tank Farm areas. All waste transfer operations are controlled by the associated SOP.

Adding Fuel Oil to a Blend Tank

If the sample of the Blend Tank waste indicates that the heating value of the liquid waste is less than 7500 Btu/lb, the SS will determine the amount of fuel oil to be charged to the waste to bring the heating value above the 7500 Btu/lb minimum. After fuel oil has been added to a Blend Tank, the tank must be recirculated for a minimum of 10 minutes prior to incinerator feed operations. The actual time will be determined by the SS. This evolution is performed per SOP-BRW-01.

Initial Configuration

Initial configuration of the Blend System will be controlled by the plant operating procedure 261-SOP-BRW-01R; however, the general requirements for placing the blend system in operation are: Fuel Oil, Electrical, Fire Protection, Nitrogen System, Plant Air, Combustible Gas Monitoring, Radiation Monitoring, Waste Vent, Waste Drain are all operable and the valve and electrical lineups are complete or current.

System Startup

There are no special evolutions necessary. By performing the Initial Configuration, the blend system will be in operation.

PREREQUISITES

- Electrical power is available to operate the BRW equipment in accordance with 261-SOP-ELNH-01 480 Volt Power Electrical.
- Building sumps are available and in service in accordance with 261-SOP-WD-01 Waste Drain Operations.
- Tank Farm sumps are available and in service in accordance with 261-SOP-WTE-01 Tank Farm Sump Operations.
- (R) Tank Farm and RK Area Explosive Gas Detectors are available and in service in accordance with 261-SOP-EGD-01 Explosive Gas Detectors.
- (R) Tank Farm Radiation Detectors are available and in service in accordance with 261-SOP-AM-01 Air Monitoring.
- (R) Tank Farm Vent system is in service in accordance with 261-SOP-WV-01 Waste Vent..
- Blend Waste Tank heaters and line heat tracing is in service in accordance with 261-SOP-HTTR-01 Heat Tracing.
- Nitrogen system is in service in accordance with SOP-LN-01 Liquid Nitrogen Supply.
- Instrument Air is in service to the BRW equipment in accordance with 261-SOP-PA/IA-01 Plant Air and Instrument Air.

- Instrument Power Panel "1D" (UPS-PNL-1D) is available and in service in accordance with 261-SOP-UPS-01 Uninterruptable Power Supply and Instrument Power Operation.
- (R) The continuous corrosion monitor for Blend Tank 1 (H-262-WTE-AT-0319) and Blend Tank 2 (H-262-WTE-AT-0419) is in service and corrosion coupons are installed in the tanks through Nozzle #A-1.

[NOTE: This procedure contains steps designated as Regulatory (R), and shall not be changed without the Solid Waste Environmental Compliance (SWEC) approval.]

The Incinerator is designed to have a total maximum thermal release rate of 18.08 million BTU per hour.

The CIF is designed for maximum feed rates of 900 pounds per hour of solid waste (restrained by ashout equipment capacity), 385 pounds per hour (48 gallons per hour) of high heat waste, and 950 pounds per hour (114 gallons per hour) of low heat waste to the RK, and 191 pounds per hour of high heat waste to the SCC.

The Incinerator will not be operated with all waste streams being processed at their maximum feed rates.

Procedure 261-GOP-02 (R-1) controls sequence of SOPs used for facility startup from warm standby to normal operating temperatures. 261-GOP-03 (R-0) controls sequence of normal process operation procedures.

Normal Operation

Normal Operations consists of:

- Recirculating the contents of the Blend Waste Tank utilizing either of the Blend Recirculation Pumps
- Transfer of Blend Waste Tank contents to the RK Waste Liquid Feed Pump for burning in the RK utilizing either blend Waste Recirculation Pumps and the RK Waste Liquid Burner.
- Transfer of Aqueous Waste Tank contents to Blend Tank No. 1 utilizing the Aqueous Waste Transfer Pump.
- Transfer of Aqueous Waste Tank contents to Blend Tank No. 2 utilizing the Aqueous Waste Transfer Pump.
- Transfer of contents in Spare Tank to either Blend Tank.
- Transfer of contents in either Blend Tank to Spare Tank.

Mode 1 - Operations

A mode in which the facility is capable of performing its intended function. The CIF incineration system is allowed to receive solid and/or liquid wastes. The fuel oil burners are on, and the incineration system is above the minimum temperature 1450 ˚F RK and 1600 ˚F SCC, for incineration. The Distributed Control System (DCS) should be in Alarm Mode 1.

261-SOP-INC 02 (R-5) introduces liquid waste during normal operations. This procedure provides instructions for Consolidated Incineration Facility (CIF) Incinerator Rotary Kiln (RK) and Secondary Combustion Chamber (SCC) normal operations. This procedure introduces waste feed to the RK and the SCC.

Mode 2 - Warm Standby

A mode in which the mission of the facility is not actively being performed. The CIF incineration system is not allowed to receive solid or liquid wastes, but still retains its inventory of waste materials. The fuel oil burner(s) and/or propane igniter(s) is/ are on due to the facility transitioning either to the operation or shutdown mode. The Distributed Control System (DCS) should be in Alarm Mode 2.

Mode 3 - Cold Standby

A mode in which the facility is not operating. The CIF incineration system is not allowed to receive solid or liquid wastes, but still retains its inventory of waste materials. The fuel oil burners and propane igniters are off. System temperatures are decreasing or at ambient. The Distributed Control System (DCS) should be in Alarm Mode 2.

Routine Inspections and Surveillances

Operators are required to take mandatory rounds throughout the CIF to ensure equipment is running properly and to ensure normal operating parameters are being maintained. The following is a list of surveillance requirements or limits associated with the CIF Tank Farm:

The maximum volume in the blend tanks is 4,200 gallons each with an operating limit of 3,300 gallons. [SAR 6.3.2.7; RCRA Application Permit/section D.2.2 Table D-4, IIIE2.B.2]

The maximum heat value of liquid waste to the RK is 17,951 Btu/lb. (SAR 6.3.1.4)

The maximum flow rate of liquid waste to the RK is 385 lb/hr. [SAR 6.3.1.4, 6.3.2.7]

The incinerator liquid waste feed tanks shall be provided with nitrogen blanketing and shall maintain a minimum positive pressure of 1 - inch water column at all times. (SCDHEC IIIE2.D.2; RCRA Application Permit/section D.2.8 Record 477)

Loading and unloading areas will be inspected daily when in use. (RCRA Application Permit/section F.4.1)

Containers of ignitable or reactive wastes will be located at least 15 meters from the CIF property Line while in storage. (RCRA Application Permit/section F.5.3; SCDHEC IIIE1.G, IIIE3.E)

Inspections of valves, seals, pumps and agitators in blend waste system will be performed in accordance with 261-SUR-FE-01, Fugitive Emissions Quarterly Inspection (U). (RCRA Application Permit/section F.2.2.5.3.1)

The specific gravity of the liquids stored in the hazardous waste tanks at the CIF will be no greater than 1.05. These are called incinerator feed tanks and include: Organic Blend Tank No. 1 and Organic Blend Tank No. 2 (SCDHEC IIIE1.G; RCRA Application Permit/section C.1.2 Record 191)

Transfer pipes which are outside the dike area will be inspected for leaks on a daily basis. [RCRA Application Permit/Section D-2f(1)(c)(2)]

The entire floor and secondary containment curbs, trenches, and sumps of all container storage areas will be inspected weekly for cracks, spilling, deterioration, wet spots and liquid accumulations, and general housekeeping. [RCRA Application Permit/Section D-1a(1)]

Container storage will also take place within the tank farm containment system and the tank farm will be inspected on a daily basis. [RCRA Application Permit/Section D-1a(1)]

All of the ancillary equipment has welded flanges, welded joints, and welded connections that are visually inspected for leaks on a daily basis.(RCRA Application Permit/Section D.2.6.1.4)

The operator has the responsibility of daily observing the levels in the overflow loop seal sight glasses. The loop seal will break on negative pressure, in the tank, before the rupture disk collapses. (RCRA Application Permit/Section D.2.4.1)

When containers with free liquids are stored, the container area will be inspected weekly to verify all the containers are closed. Containers will always be kept closed. (RCRA Application Permit/section D.1.4)

3.03	Given values for key performance indicators, **DETERMINE** if Blended Waste System components are functioning as expected.

System Parameters During Normal Operation:

- Waste liquid mass flow is between 96 and 385 lb/hr as indicated on H-261-BRW-FT-1600
- RK Waste Liquid Pressure is between 3 and 65 psig as indicated on H-261-BRW-PT-1603
- Liquid Waste Temperature is between 10 and 200°F as indicated on H-261-BRW-TT-1609/13
- Steam Pressure is between 90 and 135 psig as indicated on H-261-MS-PT-1610
- Steam Flow is greater that 20 lb/hr as indicated on H-261-MS-1601
- RK Liquid Waste Bypass flow is less than 0.817 GPM as indicated on H-261-BRW-FT-1614
- Atomizing steam valve is open after temperature is above 1000°F
- Blend Tank temperature between 45-105˚F
- Blend Tank Level between 45.5-134 inches
- Transfer pump thermosiphon pressure 34±2 psig

If any parameters are not in the normal operating range, operators should attempt to determine the cause of abnormal readings, and notify the control room of the situation. Additional actions to correct the situation may be specified by the shift supervisor.

Shutdown

Procedure 261-GOP-04 controls the sequence of procedures used to shutdown normal process operations. 261-SOP-INC-03 (R-3) Normal shutdown from normal operating temperatures to warm standby conditions. This procedure is to be implemented for a planned shutdown. Certain normal maintenance activities or lack of waste material requires shutdown of the incinerator or individual burners. The fuel oil burners must remain in operation during the burning of any waste material. The Incinerator requires 1 hour of operation after solid waste feed was stopped to complete the burning of solid waste.

The Blend Waste Tank will be in continuous services with exception of removing a component from service for maintenance purposes.

The Blended Waste Transfer and Feed Pumps will normally be shutdown in the following manner:

- Depress "Steam Purge RK WL" push-button
- Steam Purge Relay seals in
- 10 second steam purge timer starts
- Pilot gas shutoff valves (H-261-PRIG-FV-1901/1903) are opened and vent valve (H-261-PRIG-FV-1902) closed
- Steam Purge Relay times out
- RK WL Shutoff valves (H-261-BRW-HV-1909/1906) close
- Waste Blend Feed Pump stops
- Combustion Air Valve fails open (H-261-FD-FCD-1917)
- Steam duration timer starts
- Steam Purge shutoff valve opens (H-261-MS-HV-1904)
- Pilot gas shutoff valves (H-262-PRIG-FV-1901/1903) are closed and vent valve(H-262-PRIG-FV-1901) open
- Steam Purge shutoff valve closes (H-261-MS-HV-1904)
- Combustion Air damper returns to control mode (H-261-FD-FCD-1917)
- RK WL fan shuts-off
- Atomizing steam valve closes when temperature is below 1000°F.

System Limitations and Precautions

- No capability exists for routing fuel oil or organic spills to the Blend Tanks. Spillage of fuel oil or organics is presently pumped from the sumps to the Aqueous Waste Tank.
- Liquids cannot be fed to a waste tank and be pumped from the same waste tank simultaneously due to the state regulation that the content of wastes being incinerated must be known and documented at all times. Additionally, wastes from one source at a time can be discharged into any of the waste tanks.
- The maximum flow rate from either Blend Tank to the RK is 385 lb/hr. This is due to the maximum capability of pumps and burner.
- The minimum flow rates of fuel oil and wastes from the Tank Farms to the RK are dependent mostly on the turndown ratio of the burners.
- Sampling and analysis will be performed for unknown wastes, new wastes and as changes in process warrant.. Department generating the waste will notify the CIF of process changes or new wastes and will arrange for sampling and analysis per the Waste Analysis Plan. (SAR 6.2.3.1; RCRA Application Permit/section C.1)
- For the receipt and processing of waste containing fissile material to continue at the CIF, a maximum of four FACILITY cleanouts (complete or partial) shall be credited with the

removal of fissile material from the FACILITY during the previous 12 - months. (OSR/LCO 3.1.2 CIF Cleanout Limit)

- Whenever a high radiation alarm in the tank farm or process stack is triggered, the applicant shall cease waste tank filling or incinerator feed, as appropriate. (SCDHEC IIIE4.G.4, NESHAP Construction/Operation Approval Letter)
- The ash content of the liquid waste feeds shall not exceed 5% by weight nor shall the ash content exceed 82 lb/hr maximum total for all liquid waste feed streams. The ash content of the liquid waste feeds shall be based on an hourly rolling average which is the sum of the hourly rolling averages of the ash content of each individual liquid feed stream. (SCDHEC IIIE4.D.2.c)
- The hourly rolling average of the total waste feed rate to the incinerator shall be no greater than 3662 lb/hr. [SCDHEC IIIE4.D.2.b. (1)]
- A report shall be submitted of all certifications of major repairs to correct leaks within seven days from returning the tank system to use. (SCDHEC IIIE2.G.3, RCRA Application Permit/section G.8 Record 282)
- Hazardous wastes that could cause the tank, its ancillary equipment, or a containment system to rupture, leak, corrode or otherwise fail shall not be placed in the tank system. (SCDHEC IIIE2.D.1, RCRA Application Permit/section D.2.8 Record 480)
- Data on the containers received from the generator will be logged onto data sheets to monitor inventory. Waste burn-out log sheets will track what is removed from the container management areas. The data log sheets will be entered into DCS computer which will monitor the amount of waste in storage along with the available capacity to ensure storage prohibitions will not be exceeded. (RCRA Application Permit/Section D-1d)
- Before waste is transferred to a tank, its composition will be reviewed to determine the proper waste category, to ensure compatibility with the other materials in the tank, and to determine it the tank will require cleaning to safely handle the waste. (RCRA Application Permit/section D.2.2.2)
- Each hazardous waste storage tank will be labeled with a statement similar to the following: "Information on the contents, quantity, and accumulation start date is located in the operating log in the control room of this facility." This information will be maintained in the facility's operating records for a period of no less than 3 years. (RCRA Application Permit/section D.2.2.2)
- Tanks will only be filled to 90 percent of capacity. (RCRA Application Permit/section D.2.2.2)
- If hazardous waste tank systems leak, the operator will, by using the waste feed cutoff for the tank, immediately stop any waste flowing into the tank. The waste will be removed from the system as fast as can be safely accomplished (within 24 hours if practical) and put in a spare tank using the permanently installed transfer pumps. The CIF Facility Emergency Coordinator will be notified. (RCRA Application Permit/section D.1.1.5

- Upon receipt of waste, it will be recorded in the operating record. Either a lab analysis of the waste or data to support process knowledge will be contained in the operating record. (RCRA Application Permit/section C-3a)
- Liquid wastes incompatible with other waste will be placed in a dedicated tank or will not be accepted. Waste incompatible with the incineration system materials of construction will not be accepted. (RCRA Application Permit/section C-2f.2)
- Laboratory compatibility tests will be performed prior to every addition to a tank/container unless the tank/container contains the same material as the waste being added, process knowledge demonstrates the waste being added is compatible with the waste in the tank, or the tank is empty. (RCRA Application Permit/section C.2.6)
- Open flames or the potential ignition sources will not be permitted in the areas where ignitable wastes are stored. (RCRA Application Permit/section C.2.6, F.5.1, F.5.2)
- Spark proof tools will used on all containers and equipment storing or handling ignitable wastes. (RCRA Application Permit/section C.2.6, D.1.4, F.5.1, F.5.2)
- Only waste generated at the SRS will be stored/incinerated at the CIF. (RCRA Application Permit/section C.2.5)
- Each hazardous waste stream routinely generated at the SRS, except for job control wastes, will be analyzed at least annually and when a significant process change occurs. (RCRA Application Permit/section C.2.4)
- Each batch of liquid or waste blend accumulated in one of the CIF waste storage tanks will be analyzed before the waste is pumped to the incinerator. (RCRA Application Permit/section C.2.4)
- Prior to adding new waste to the tank feeding the incinerator, the waste transfer from the tank to the incinerator must be terminated. (RCRA Application Permit/section C.2.4)
- If sufficient process knowledge exists on a particular waste, it will be analyzed for only the parameters reasonable expected to be present in the waste. (RCRA Application Permit/section C.2.1)
- The specific gravity of the liquids stored in the hazardous waste tanks at the CIF will be no greater than 1.15. (RCRA Application Permit/section C.1.2, D.2.2 Table D-5)
- When tank filling or incinerator feed has been terminated due to a high radiation alarm then tank filling or incinerator feed shall not resume until the cause for the associated high radiation alarm has been identified and corrected. (NESHAP Construction/Operation Approval Letter)
- CIF shall notify the Agency whenever the cumulative inventory charged to the incinerator for any radionuclide reaches a level that is equal to or greater than 75 percent of the annual quantities expected to be charged at the facility.. (NESHAP Construction/Operation Approval Letter 4APT-AC)
- CIF shall maintain a log of all radioactive material receipts for the facility and shall include the following information in the log: the date of the shipment, radionuclide inventory at the time of shipment, the date of receipt verification results if conducted, comparison of the

verification results with the reported inventory, and the date of incineration. (NESHAP Construction/Operation Approval Letter 4APT-AC)

- New sources of waste that are added to the waste stream must be sampled and analyzed for heat value and total halogens, and the results of the analysis must be submitted to the (SCDHEC) Bureau prior to incineration. (Construction Permit 0080-0041-H-CG Section C)
- The mass feed rate of the waste liquid stream shall be continuously monitored and the data stored on magnetic media that may be used to print the information in report form. (SCDHEC Air pollution control permit B.2.d)
- The tank farm carbon canister bypass line valve shall be locked closed. (SCDHEC Air pollution control permit B.2.c)

Infrequent Operation

Abnormal operations of the Blended Waste System include all events that are not performed on a regular basis, but do not necessarily imply "something is wrong."

System Flushes

Occasionally it may be necessary to perform a system flush of the Blended Waste System to eliminate localized radioactive hot spots or for other reasons determined by the SS. These flushes are normally performed using fuel oil. The Blended Waste System is provided with 1-inch flanged ball valves throughout the system to make connections with the oil flushing line. The Fuel Oil Transfer Pump provides the necessary head to flush the lines.

ELO 2.04	**Given a description of abnormal equipment status for the Blended Waste System, EXPLAIN the significance of the condition on system operation.**
ELO 2.05	**Given a description of the Blended Waste System equipment status, STATE any corrective actions required to return system operation to a normal condition.**
ELO 4.02	**DETERMINE the effects on the Blended Waste System and the integrated plant response when given any of the following:** **a. Indications/alarms** **b. Malfunctions/failure of components** **c. Operator Actions**

Abnormal Events

An Abnormal Operational Event (AOE) is defined as any loss of function of a safety or support system. The loss of these systems could possibly result in a shutdown of the facility or in limited personnel contamination. The type of action to be taken is dependent on the type and severity of the AOE. Component failure in any of the following (See Table 4,

Abnormal Operating Events), could indicate a problem in the Blended Waste System or Tank Farm in general, and would result in initiation of AOP-WTE-01:

• Pump / Valve Seals	• Pump / Valve Failure
• Nitrogen Blanketing System	• Tank Vent System
• Loop Seal System	• Liquid Sampling System
• Fire Suppression System	• Loss of Instrumentation
• Rupture Disk Alarm	• LOW / HIGH Tank Level Alarms or Switches
• LOW / HIGH Tank Temperature Alarms or Switches	• LOW / HIGH Tank Pressure System
• N2 Tank LOW Level Alarm	• N2 Tank LOW / HIGH Pressure Alarm
• Constant Air Monitors	• Sump Pump Operational Failure
• Unloading Line Filters	• Tank Heater System
• Tank Agitator	• LOW / HIGH Tank Level System
• LOW / HIGH Tank Pressure System	• HEPA Filter System
• Rupture Disk System	• Loss of Main Nitrogen
• Explosive Gas Detectors in Alarm	• Piping Heat Tracing Malfunction
• Corrosion Detector Alarm	• HIGH Tank Temperature NOT caused by Tank Heater System Failure (Signifying Possible Exothermic Chemical Reaction).

Table 4 Abnormal Operating Events

Individual tanks or the entire Tank Farm may shutdown depending on the failure that occurs. The Blend Waste system interfaces with the other CIF systems (Steam, RK, and etc.) and the unusual events are mitigated by administrative procedures (AOP/ARPs) and interlocks.

Mandatory Shutdowns 261-SOP-INC-04 (R-2)

This procedure applies to the CIF, specifically the Rotary Kiln Incinerator and the Secondary Combustion Chamber (SCC), and will direct Mandatory Shutdown of the incinerator from an operating condition to partial or full shutdown, dependent upon the initiating condition(s). The mandatory shutdown is accomplished in the same manner as the normal shutdown.

Emergency Shutdowns 261-SOP-INC 05 (R-2)

Procedure 261-SOP-INC 05 (R-2) governs the emergency shutdown of the CIF burners and their associated waste streams. The emergency shutdown of the incinerator will automatically terminate the blend waste feed and close the shutoff valves--(H-262-BRW-FV-1909/1906).

Periodic Maintenance

Periodic maintenance and testing of Blended Waste System components is required to meet safety and permitting requirements. The following is a basic list of required maintenance or testing.

- Monitoring tank wall thickness. [SCDHEC IIIE2.C.2.c (iii, ii, & i)]
- Tanks shall be open every two years for visual inspection. [SCDHEC IIIE2.C.2.c (iii)]
- Monitoring tank wall thickness shall be concentrated at areas on the tank shell which are most likely to be in frequent contact with stored liquid. (SCDHEC IIIE2.C.2.b)
- Monitoring tank wall thickness shall be performed by an individual trained in the use of shell thickness measuring equipment.(SCDHEC IIIE2.C.2.a)
- The emergency waste feed cutoff system and associated alarms and sensors will be inspected on a daily basis. The remaining, more reliable parts will be tested on a monthly basis. (RCRA Application Permit/section F.2.2.5.2; SCDHEC IIIE4.F.3; IIIE4.H.2)
- Tank corrosion will be monitored by periodic thickness testing, internal visual inspection and by use of coupons and electrochemical probes to detect unexpected corrosion. (RCRA Application Permit/section D.2.2.2)
- See Table 5, *Equipment Inspections*. Inspection of various equipment will be conducted in accordance with the following table (RCRA Application Permit/section F.2.2.5.1; SCDHEC IIIE4.F.1):

Area/Equip.	**Specific Item**	**Types of Problems**	**Inspection Frequency**
Emergency and Service Equipment	Storm drain plugs/cover	Missing/broken	Monthly
	Explosive gas detection system	Power, calibration	Monthly
Tank Farm, Container Storage & Unloading Areas	Dikes and curbs	Cracks, deterioration	Daily
	Trenches and sumps	Cracks, deterioration, wet spots, spalling	Daily
	Piping, pumps, and sump pumps	Leaks, corrosion, deterioration	Daily
	Valves and fittings	Leaks, corrosion, deterioration	Daily
	All tank overfill prevention devices(Level indicators & alarms)	Nonfunctional	Daily
	All temperature indication and alarms (none required on fuel oil tank)	Nonfunctional	Daily
Unloading Area	Floors and curbs	Waste spills and wet spots	Daily
	Floors and curbs	Waste spills, cracks, deterioration and spalling	Weekly
	Surrounding area	Dead vegetation	Daily
	Tank conservation vents	Spring settings, sticking	Yearly
Tanks (external)	Foundation/structural supports	Cracks, deterioration, spalling, wet spots, corrosion	Daily
	Protective coating	Blisters, peeling	Daily
	Walls, roof, bottom	Discoloration, corrosion, cracks, bulges, buckles	Daily
	Nozzles	Leaks, cracks, corrosion	Daily
	Anchor bolts	Corrosion	Daily
Tanks (internal)	Shell	Corrosion and cracking	Every 2 years

Table 5 Equipment Inspections

Summary

- Operations associated with the Blended Waste System are controlled per SOP-BRW-01, Blended Radioactive Waste Operations (U).
- Procedure 261-GOP-02 (R-1) controls sequence of SOPs used for facility startup from warm standby to normal operating temperatures.
- 261-GOP-03 (R-0) controls sequence of normal process operation procedures.
- Operators are required to take mandatory rounds throughout the CIF to ensure equipment is running properly and to ensure normal operating parameters are being maintained.
- Procedure 261-GOP-04 controls the sequence of procedures used to shutdown normal process operations.
- 261-SOP-INC-03 (R-3) Normal shutdown from normal operating temperatures to warm standby conditions. This procedure is to be implemented for a planned shutdown.
- Procedure 261-SOP-INC 05 (R-2) governs the emergency shutdown of the CIF burners and their associated waste streams.
- An Abnormal Operational Event (AOE) is defined as any loss of function of a safety or support system. The loss of these systems could possibly result in a shutdown of the facility or in limited personnel contamination. The type of action to be taken is dependent on the type and severity of the AOE.
- Periodic maintenance and testing of Blended Waste System components is required to meet safety and permitting requirements.